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MAGAZINE

HARDWARE

**10 Desktop Plotters
Deliver Low-Cost
Color for CADD and
Presentations**

LAB NOTES

**Microsoft Word
Tips: How to Build
Style Sheets and
Macros**

SOFTWARE

**12 High-End CADD
Packages: Database
Hooks, Workgroup
Potential, True 3-D**

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**Free Pop-Up
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SCHEDULE
Makes Your Day**

MARCH 27, 1990

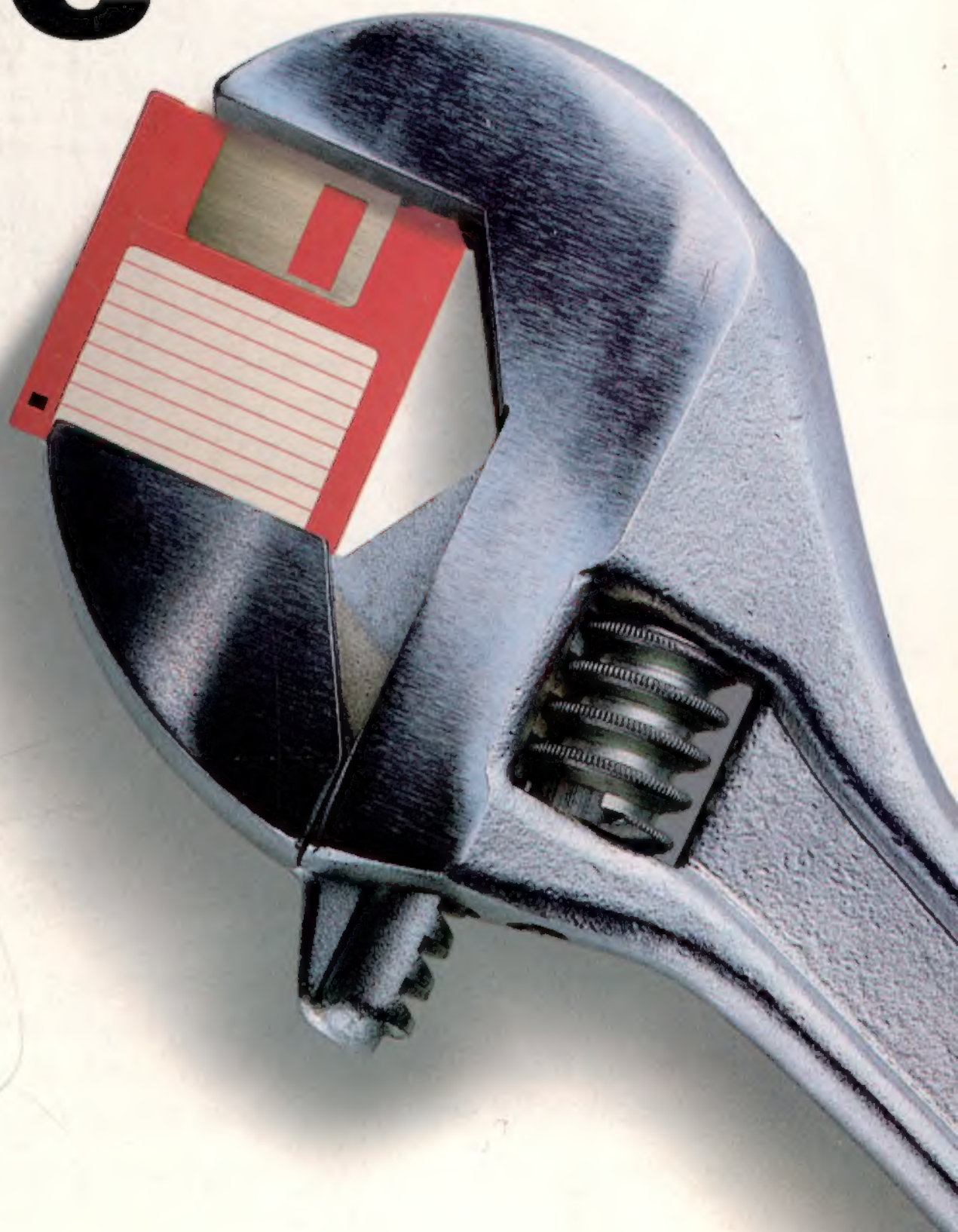
THE INDEPENDENT GUIDE TO IBM-STANDARD PERSONAL COMPUTING

VOLUME 9 NUMBER 6

DOS Tools Torture Test!

**PC Labs Finds
Dramatic
Differences in**

- Norton Advanced
- PC Tools
- Mace
- Baker's Dozen
- Take Charge!



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pages than it
has in the last
ten years.

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Market Survey and Ten-Year Growth Plan

EXECUTIVE SUMMARY

BLUE YONDER AIRWAYS



Introduction

As Blue Yonder Airways moves from freight to passenger service, the Sales and Marketing Division is presented with a multitude of new challenges and opportunities. This report consists of a marketing proposal for the next ten years -- a virtual blueprint for growth in our critical first decade as a passenger carrier. Our

resulting from a series of focus groups conducted by the market research firm Crump & Graham. The growth plan includes specific suggestions for ways to leverage our track record in the freight arena to build out our share of single-passenger bookings, and ultimately expand into general sales. A detailed analysis of costs and

The Computer the Competition Loves to Hate. The ALR PowerFlex

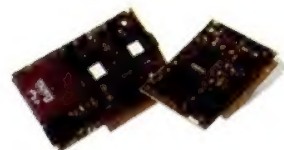
1250MHz



We're not talking bells and whistles. We're talking ALR's PowerFlex performance.



\$1495



ALR's PowerFlex 386SX and i486 Modules eliminate any possibility of future obsolescence.

The powerful 40-MB hard disk, standard on the PowerFlex, holds approximately 20,000 pages of documentation.



With today's leap-frogging technology, it takes more than just a faster PC to make the competition so upset. You have to deliver something they can't. The 286-based PowerFlex easily upgrades to 386SX™ or i486™ processing. And whatever future processing holds, the PowerFlex's innovative bus design holds your key to tomorrow. That's why the PowerFlex has received so much attention from today's premier computing publications. Byte Magazine wrote, "The PowerFlex offers the widest upgrade path that's currently available." The ALR PowerFlex was built with your future in mind. As technology and your processing needs grow, the PowerFlex can grow with you.

"The PowerFlex is the most versatile system on the market."

BYTE November 1989

Still, the PowerFlex delivers much more. For a base price of only \$1495 you'll get a 12.5-MHz 286-based PC and 1-MB of RAM with built-in EMS 4.0 support, one 3.5" 1.44-MB floppy drive, a 40-MB hard disk and 101-key enhanced keyboard. Add only \$395 and you've upgraded to 16-MHz 386SX power and speed. The PowerFlex 386SX Module allows you to increase processing speeds by more than 25% and more importantly, gain immediate compatibility with all 386-based 32-bit software. We're even making i486 technology easily accessible. The PowerFlex i486 Module increases processing speeds by more than 510%. And for only \$2995, the cost of ALR's i486 upgrade solution, you'll have "One of the least

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4 Internal Drive Bays
40-MB Hard Disk
386SX Upgradeable
i486 Upgradeable
\$1495

Epson Equity II™
12-MHz 80286
640-KB RAM
1.2-MB Floppy
6 Expansion Slots
4 Internal Drive Bays
40-MB Hard Disk
Not Available
Not Available
\$2999

expensive 80486s on the market".
Byte November 1989

To see in person just why ALR's PowerFlex has the competition so upset and get the name and phone number of your local authorized ALR reseller please call:

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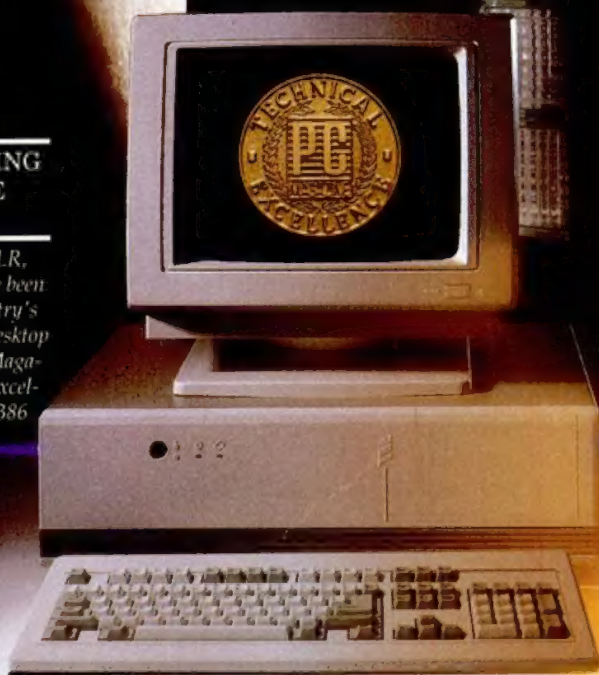
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Manufacturer System	ALR FlexCache 25386DT Mod. 40	AST [™] Premium [™] 386SX/16 Mod. 40
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Memory Cache	64-KB	16-KB
Floppy Drive -Std.	1.2-MB	1.2-MB
Hard Drive	40-MB <28ms	40-MB <28ms
Avail. Slots Total	8	7
Landmark Benchmarks *	41.5	23.1
Price	\$2695	\$3595
Video (VGA)	\$295 Opt.	Std.
25-MHz 80386 CPU	Std.	\$3295-Upgrade AST Fastboard [™] 386/25
Price	\$2990	\$6890

* Landmark Software version 1.1 benchmarks.

The higher the rating the better.

* MIPS performance is based on the ratings of CPU/Memory in million instructions per second, MIPS Source PowerMeter[™] version 1.5 The Data Base Group, Inc. Upland CA. Disk access and transfer rates based on CORE Test 2.8 (CORE laboratories), CORE International.

New For The 90's. ALR's FlexCache 25386DT Model 40 **\$2695**

To kick off the new year right, ALR is offering the award-winning FlexCache 25386DT Model 40 at a price guaranteed to prompt celebration,

\$2695.

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The FlexCache 25386DT Model 40 is configured with 1-MB of RAM, 64-KB cache a 1.2-MB floppy drive in the classic desktop AT-chassis and a high-performance 40-MB (28ms) hard disk. With a 691-KB/sec. transfer rate, the 40-MB hard disk of the FlexCache 25386DT delivers 180% faster accesses and 60% faster data transfers as compared to the IBM[™] PS/2[™] Model 50 with its 20-MB hard drive.

Discover just why PC Magazine wrote, "the ALR FlexCache 25386 can't be beat."

- January 17, 1989 -

ALR designs the most comprehensive line of ISA, Micro Channel[™] and EISA-based PCs ranging from the 12.5-MHz 286 PowerFlex to 33-MHz 386 and

25-MHz i486 PowerCache 4 high-performance systems. To get additional information on the ALR FlexCache 25386DT and ALR's complete line of high-performance PCs as well as the name and number of your local authorized ALR reseller, please call:

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CIRCLE 291 ON READER SERVICE CARD

Inside

PC Magazine's product evaluations aren't conducted in secret. Reviewers keep in touch with technical support representatives of the products they evaluate, especially when aberrant or contradictory results pop up in testing. Contributing Editor Edward Mendelson learned this lesson when he evaluated *The Norton Utilities* for this issue's cover story on DOS utilities.

Mendelson recalls, "I knew I would have to run the data recovery programs on a real-world disk with real-world data, and the only data I was willing to risk losing was my own. So I backed up, swallowed hard, and started demolishing the boot sectors and file allocation tables on one of my hard disks."

"The Disk Doctor program in *The Norton Utilities, Advanced Edition* has the ability to restore a damaged boot sector. But when I tried it on my disk, it didn't work. I called the technical staff at Peter Norton Computing, and they insisted that they could restore a damaged boot sector and frequently did so in demonstrations. They couldn't imagine why it wasn't working for me."

"As we compared notes on our two systems, it became clear that I was using IBM's latest unnumbered upgrade to DOS 4.01, which included some files dated April 1989 that had been available for almost six months. Norton didn't have a copy, and it was



obvious that something had changed between the versions. The man from Norton promised to get the latest version as soon as we got off the phone.

"By the next morning they had located a copy, found that IBM had indeed changed the rules in the upgrade, and were already preparing an upgrade to Disk Doctor."

If you look at the evaluation of 12 CADD packages in this issue, you'll see that we tried to compare the same

features in different products by means of our suitability to task ratings. These ratings give you a systematic way to judge a program's ability to handle specific tasks.

Why do it?

In order to flag programs with outstanding individual features, even if they don't win the Editor's Choice. Along

with features tables and benchmark tests, the ratings can help you make the right software choices.

While *PC Magazine* continues to be a valuable resource in helping you select products, we've been listening to readers' gathering concerns about support and service. We address those concerns in this issue by asking you to complete a survey of your experience with service and support. Your experiences—both good and bad—are critically important to building an objective study of reliability. We will report our findings in an upcoming issue.—Donald P. Willmott



Contributing editor Edward Mendelson plays computer mechanic to damaged disks for this issue's review of DOS utility software.

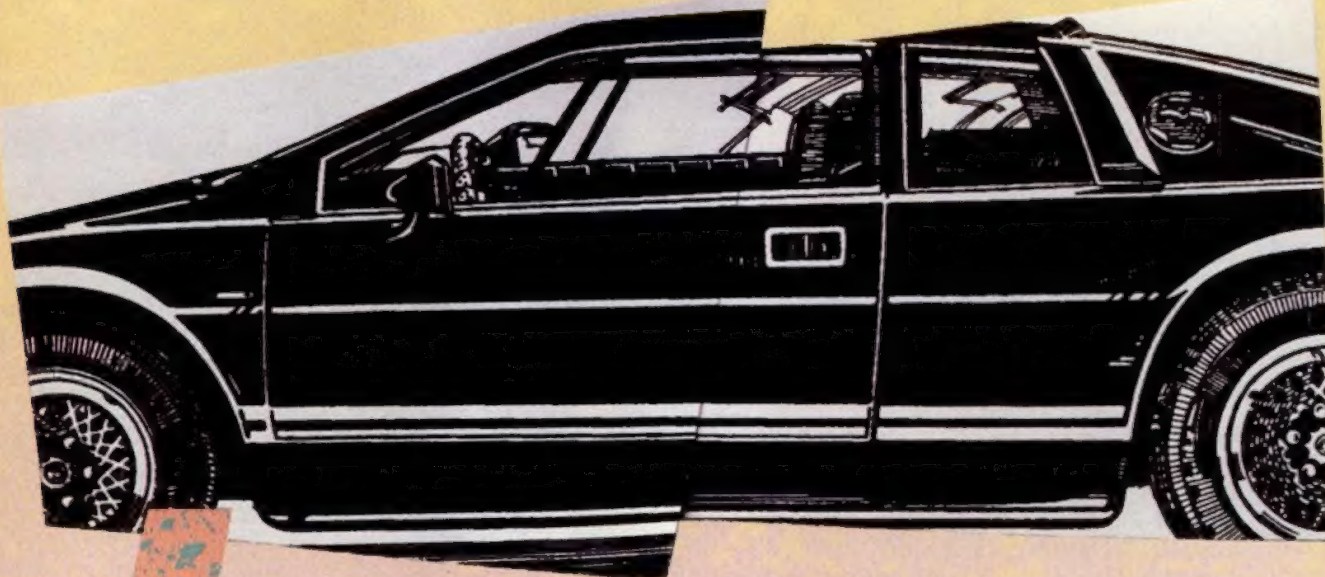
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November 1988

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printer's Canon® SX® print engine covers solid areas and prints fine detail better than previous-generation engines.

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Notebook-size **Toshiba T1200XE** features 286 power, a 20MB hard disk, and a crisp display.

QEMM-386 memory manager frees up more RAM than your 386 machine ever knew it had.

Plus HardCard II squeezes 80 more megabytes of disk storage into 286 and 386 machines.

Disc Director helps optimize hard disk usage while managing files.

RoundTrip integrates spreadsheet applications with dBASE, ASCN, and other worksheet files.

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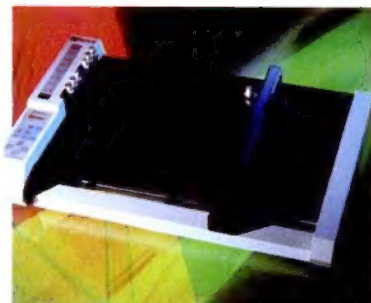
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Survivors: Desktop Plotters Face the Competition

Winn L. Rosch/

In today's world of smarter, smaller, and in some cases color laser and thermal transfer printers, desktop plotters may look like yesterday's news. But look again. They're cheaper, more versatile, and able to draw on a wider variety of media than most of their printer competition. PC Labs tests ten desktop units.



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- *Design Your Own Home* helps you visualize your dream house.

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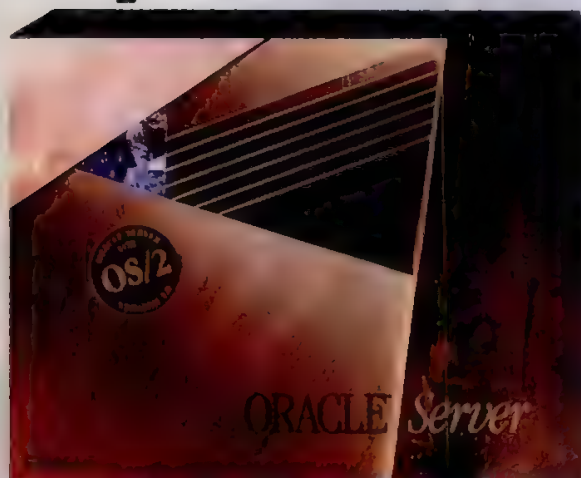
PC MAGAZINE REVIEWS

Except where noted: All *PC Magazine* reviews are of currently available products. Comparative reviews are arranged alphabetically by product name for software, by company name for hardware. Software is free from copy protection. On benchmark test charts, shorter bars indicate faster products (less time to complete a task). Benchmark and performance tests are run on 8-MHz IBM PC ATs.



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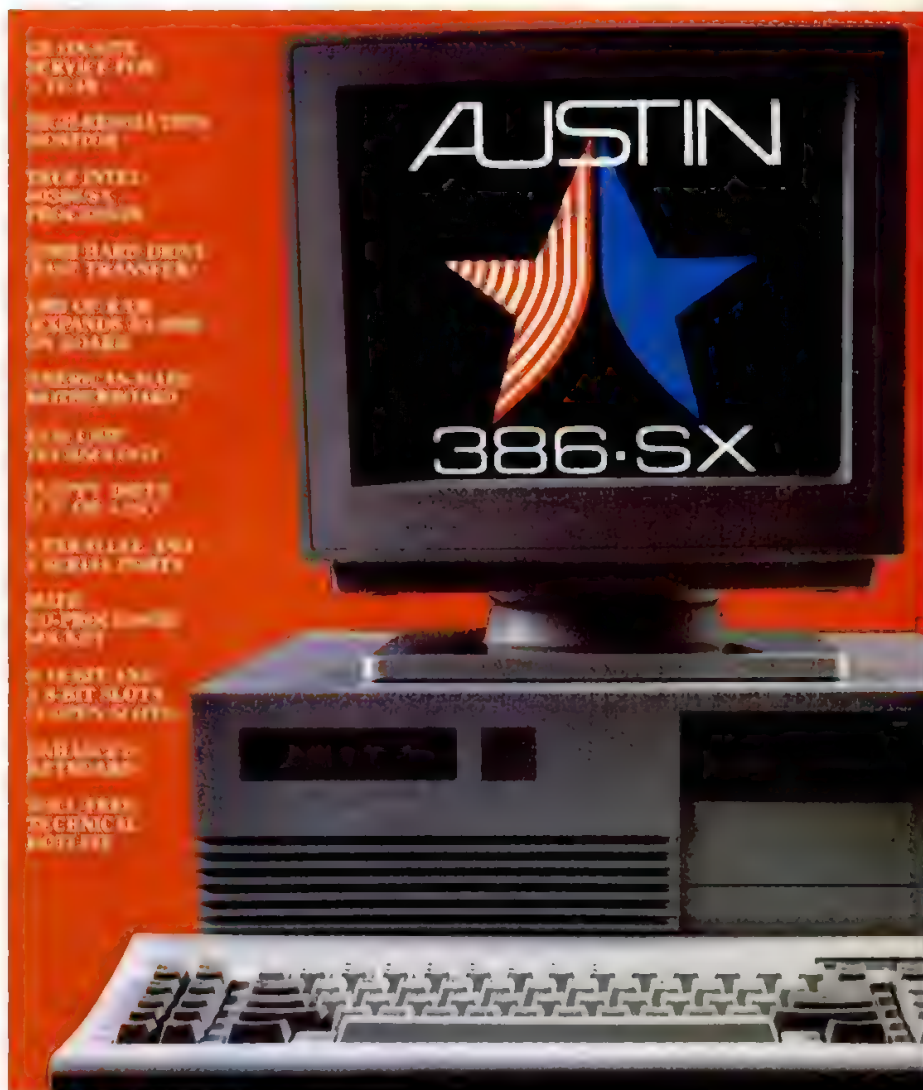
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EDITOR'S CHOICE
PC MAGAZINE (USA)
JANUARY 30, 1990



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PC MAGAZINE (UK)
FEBRUARY, 1990

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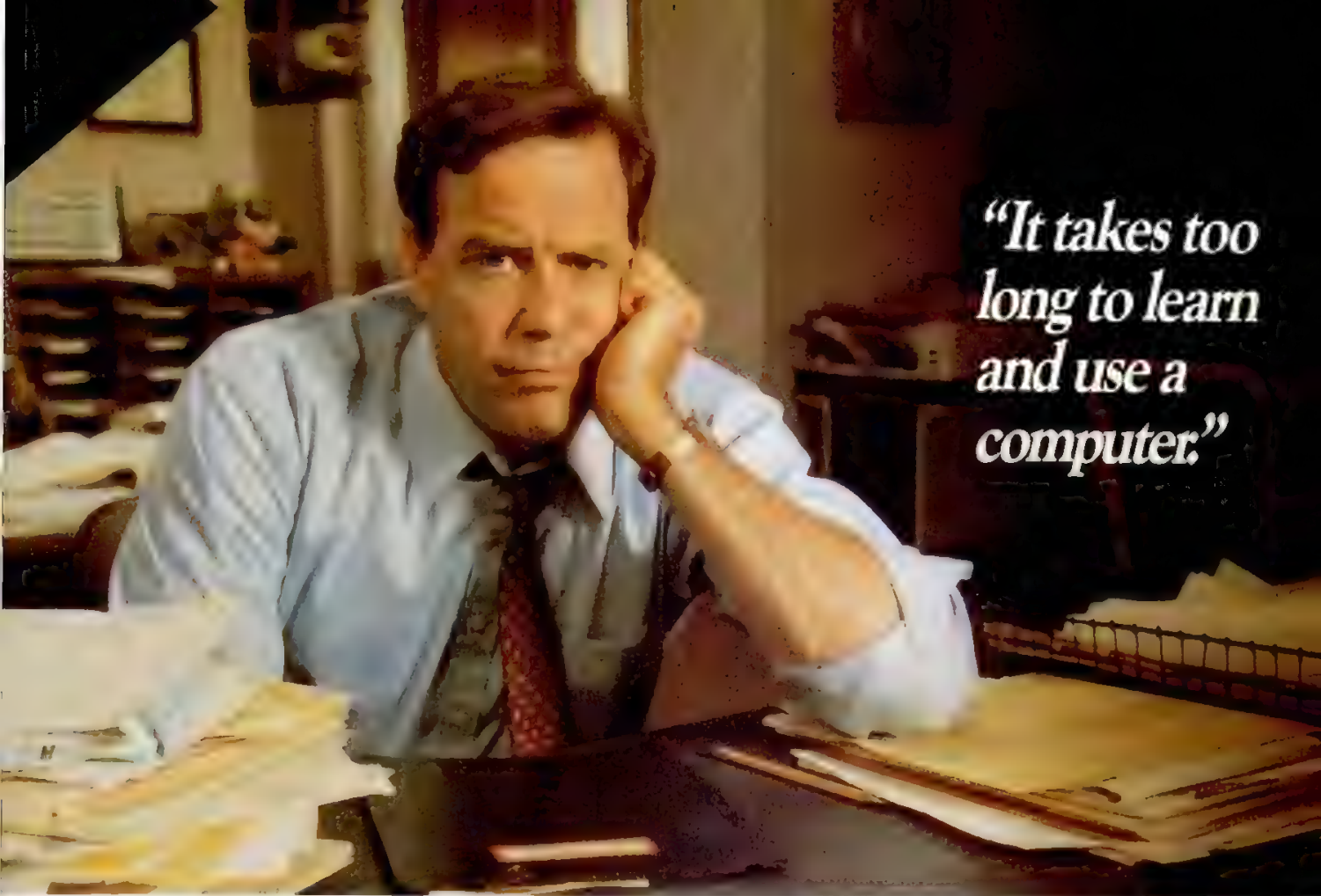
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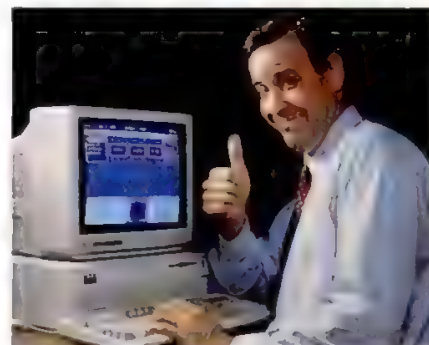
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(Foot) Letters

☒ PRESS POUND TO CONTINUE *(8/11/89)*

I thoroughly enjoy John C. Dvorak's column. So much so, in fact, that it is the first page I read after the table of contents. It is very seldom that I disagree with his opinions (as controversial as they may be). However, his article condemning voice mail (John C. Dvorak, *PC Magazine*, December 26, 1989) warrants a rebuttal.

With proper implementation, voice processing can have unlimited uses. For example, a message can be left in a mailbox, which in turn can outdial and activate a pager and download digits to notify a doctor which hospital to report to. I would hardly consider that being "unable to get in touch" with someone.

There was a time in the early '70s when word processing systems were considered "annoying." Today, however, they are absolutely essential for all types of business. With the rapidly increasing availability of practical voice-processing applications—voice mail, in particular—voice processing will become an essential, language-independent aid to communication.

With the technological advances in digital signal processing, improved speech compression and decompression algorithms, and increasing user awareness of the benefits of voice processing, the '90s promise to be the decade of cost-effective, "user-friendly" telephone information-processing applications.

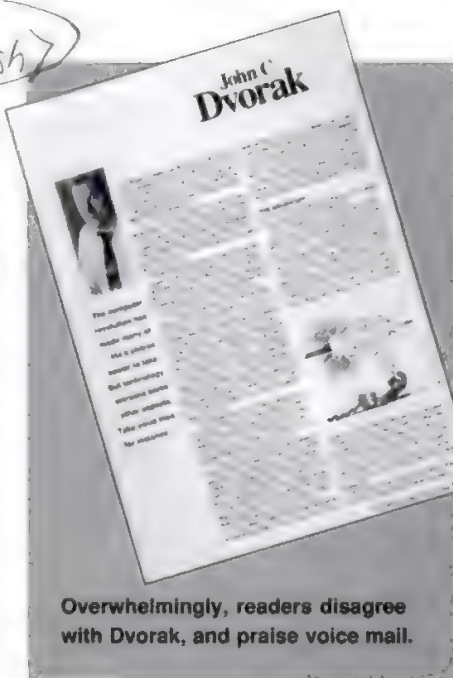
Peter Connor

Chelmsford, Massachusetts

(Hr) In his December 26, 1989, column on voice mail, John C. Dvorak was as far off the track as he has ever been.

As an employee of a company that uses voice mail, I was saddened by the ignorance expressed by an outsider who acts like he has never had the experience of using voice mail as a tool.

We use voice mail to answer the calls that we receive while we are away from our desks. I, for example, am away from my desk at least 50 percent of the day (I



Overwhelmingly, readers disagree with Dvorak, and praise voice mail.

am the micro support specialist for my company). I am responsible for the repair and servicing of all PCs within our company. Therefore, I get many in-house calls, as well as many outside calls from vendors.

Just because my voice mail answers the phone doesn't mean that I do not care for the people calling! Far from it. If I didn't have voice mail, it would be hard for anyone to get in touch with me.

Richard Fowler

Carson, California

I strongly disagree with John C. Dvorak's voice mail putdown. In fact, I love voice mail—mainly because it gives me the opportunity to tell my story, in my words.

Shell Sennett

Los Angeles, California

(Hr) Contrary to what John C. Dvorak may think, the "real message" that voice mail sends is this: "Your message is very important to us, and we want to make sure we know not only that you called, but also what you called about. This way, when someone returns your call, he will have

an answer for you rather than waste further time trying to find out what you called about in the first place."

Scott B. Diamond

Levittown, New York

☒ THE BIGGER PICTURE *(8/11/89)*

Bill Machrone's column in the December 26, 1989, issue of *PC Magazine* discussed the concept of commercial agnosticism, but I suspect that even he may not be aware of its full impact.

Commercial agnosticism is essentially contrary to the free-enterprise model to which we pay lip service. As Machrone pointed out, in a model free-enterprise system, vendors take positions. Some vendors are rewarded and some are penalized, but the consumer benefits in the long run because contrary ideas are brought to the consumer's attention in a very forceful way. The consumer then votes with his wallet. It may not be a perfect system, but it is an order-of-magnitude improvement over the mechanisms used in other economies.

Since only the largest and most-entrenched firms can afford to cover all the commercial alternatives, commercial agnosticism leads to the selection of a vendor based upon irrelevant and suboptimal criteria, such as a firm's image and the size of its coffers. Small firms, which have traditionally been the innovators in our economy, are clearly at a disadvantage if such a philosophy prevails.

Philip G. Duffy

West Chester, Pennsylvania

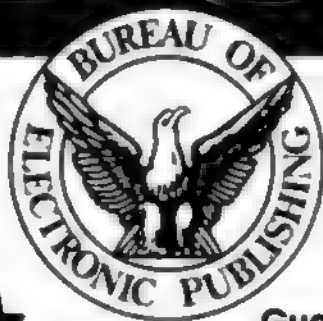
☒ NO PIE-IN-THE-SKY PURSUIT *(8/11/89)*

I like John C. Dvorak. This industry needs more people who tell it like it is. However, his attitude toward Zenith (Inside Track, *PC Magazine*, December 12, 1989) is, frankly, outrageous.

Dvorak states that "Zenith sold the computer division to concentrate on high-definition TV, a pie-in-the-sky pursuit if there ever was one."

Pie in the sky, John? HDTV? You have

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Letters

just revealed a chink in your credibility large enough to drive IBM through. HDTV will unquestionably be the most important consumer technology of the next ten years.

**Rather than bad-mouth
Zenith, John Dvorak
should extol the
company for its
commitment to the
American consumer-
electronics industry.**

HDTV heralds the mating of television and computers, enabling hypercard-type consumer gateways into any imaginable knowledge base. I think "inevitable future in the sky" would be the more accurate term.

Dvorak also claims that Zenith is already "years behind" the Japanese. If he were actually up on the issue, he would realize that although the Japanese are first on the market with an HDTV implementation, theirs is based on relatively outdated analog technology. Hence, Zenith has an opportunity to leapfrog the Japanese by springing directly into the development of a completely digital HDTV system, a technology for which the company is already primed.

Rather than bad-mouth Zenith, Dvorak should extol the company for its commitment to the American consumer-electronics industry. It is precisely because of the magnitude of this commitment that Zenith sold the Data Systems division.

Mike Warner

San Jose, California

As the owner of a Zenith PC, I hate to see the company sold. However, John C. Dvorak's "give up" attitude regarding Zenith's pursuit of the Japanese in the HDTV market disgusts me. This seems to be the attitude of the present day: if we can't beat 'em, join 'em or quit. And it's the

kind of attitude that has allowed Japanese companies to outsell their American counterparts.

We need more American companies like Zenith, companies that are willing to compete with the Japanese on their own ground. We should support the efforts of Zenith, not bash them.

William Clark

Covington, Kentucky

FAIR SHAKE?

Edward Mendelson really missed the point in his lukewarm review of *DeScribe*, the first word processor for Presentation Manager (First Looks, *PC Magazine*, November 28, 1989, p. 35). He paid lip service to some of the important features and then focused on a lot of trivial problems, blowing them out of proportion in relation to the benefits.

I've been using *DeScribe* for about a month, and it's a dramatic improvement over the DOS programs that I'm now tossing in the round file. How many DOS programs are WYSIWYG all the time? How many DOS programs display text proportionally or have convenient WYSIWYG control over letter and word spacing, font size, etc.? *DeScribe*, with OS/2, does these things.

All in all, I think this program is a major qualitative step forward. OS/2 is finally beginning to show some real benefits.

Robert Mayer

San Francisco, California



Features are nice; features well implemented are nicer. Much of what you get in *DeScribe* is available in the new word processors for *Microsoft Windows*, without the annoyances of *DeScribe*. As the review said, if you need a Presentation Manager word processor, *DeScribe* is the only choice. But other choices are coming up fast.

—Ed Mendelson

IT WORKS FOR HIM

In reference to your recent review of *Microsoft Works*, Version 2.0 (First Looks, *PC Magazine*, November 28, 1989, p. 48), I have to say that I don't agree with Jonathan Matzkin's description of the "typical" *Works* user: one who has "little need for external applications."

In my experience, most users are deeply involved with one or two applications; John C. Dvorak's recent editorial (John C. Dvorak, *PC Magazine*, September 12, 1989) seems to support this. In

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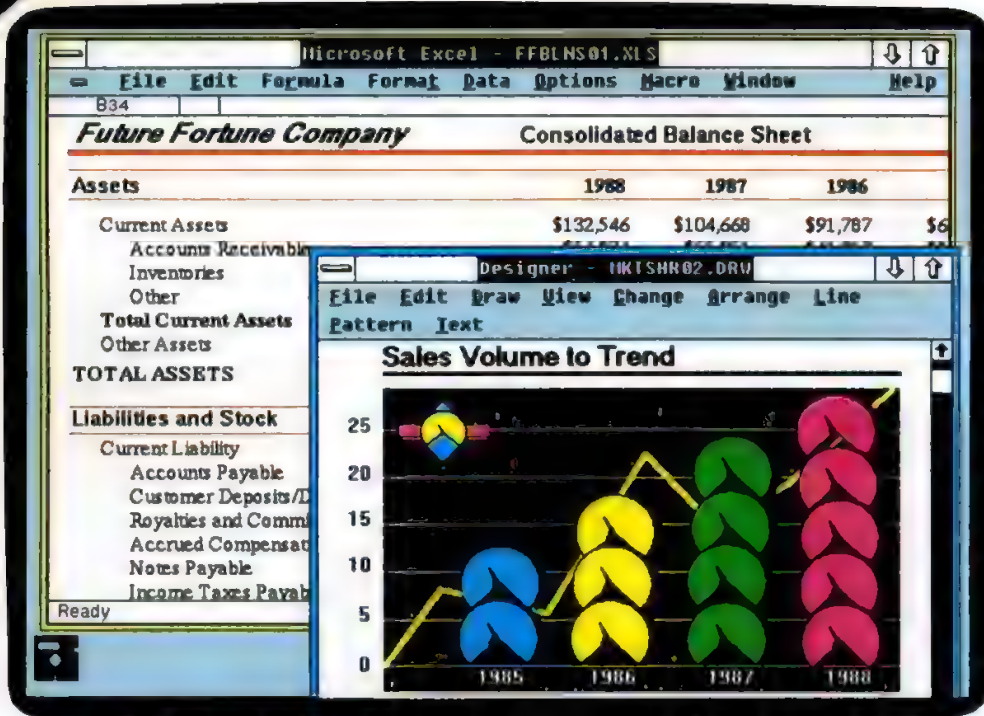
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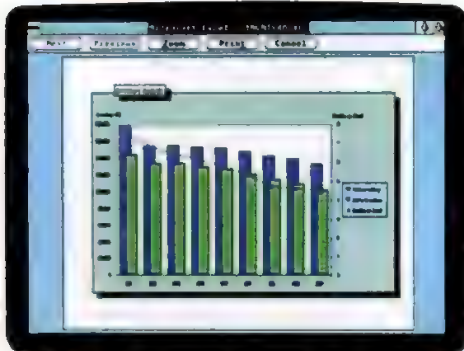
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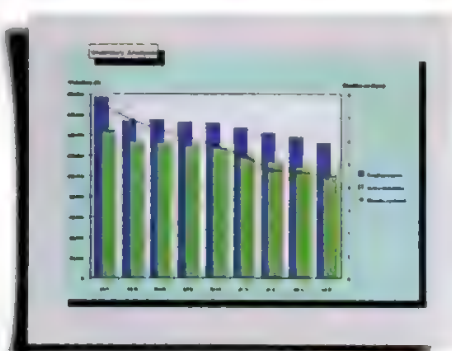
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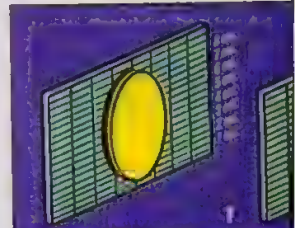


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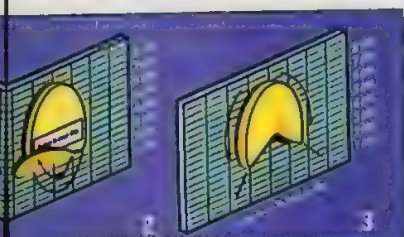
Old sayings may cost Future Fortune

It has been roughly 68 years since FFC last created new fortunes. But in light of the new logo and the whole new look brought to the company in the past year, the board of directors has unanimously voted to replace the old fortunes. President Jim Dearing explained, "As we exit the 1980's, people no longer believe in the same old lines, it's time to change".



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Write Cookie Standards, rolling in the dough



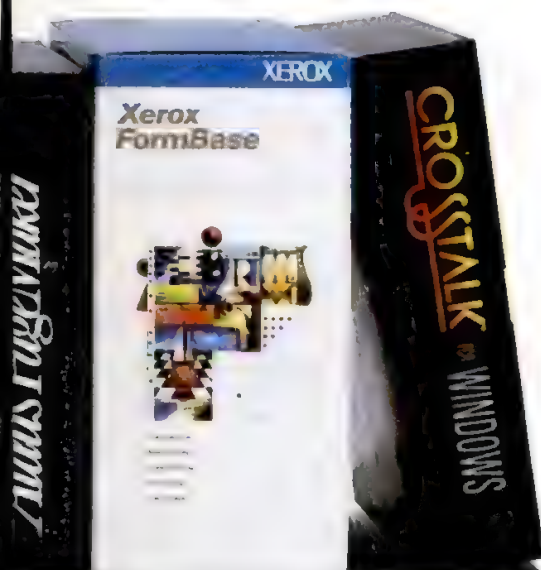
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... the lower third of the
... ough, and slightly to the
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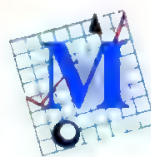


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Letters

other areas, these users need accessibility more than features. That is when a program like *Works* is worth its weight in gold.

I use the *Works* word processor, spreadsheet, and communications modules for all my general needs, but when it comes to developing strategic solutions for shipboard management (I'm a captain in the Navy), I work in *Clipper*. A lot of users might find such a solution, tailored to their own needs, far more productive than trying to master four individual "heavy-weights" or one of the "do-everything" integrated programs.

Chuck Becker
San Francisco, California

HARDER THAN IT LOOKS

I was surprised to read your comments about memory management in your review of *The Complete Communicator* (First Looks, *PC Magazine*, December 12, 1989, p. 46). Although Intel is to be highly commended for being able to "tuck most of its software away into expanded memory" for its Connection CoProcessor, that feat is by no means as easy to achieve as your review implies.

We are software developers with no connection to *The Complete PC*; in fact, we have worked closely with Intel's board. In the course of our own work, we have run up against the problem of TSR code that is too big for comfort. Rewriting it to fit in expanded memory is a tough, nasty job. If you know some way to make it trivial, we would certainly like to hear about it.

Criticize programs for their size all you want; everyone needs all the room he can get. But please don't mislead the public into thinking the problem is a "minor and easily correctable flaw."

Patricia Neuendorf
Neuendorf Systems
Aurora, Indiana

TYPING AT LIGHT SPEED

In his January 16, 1990, column, Bill Machrone mentions *PRD+* (*Productivity Plus*), from Productivity Software International. Mr. Machrone also suggests that *PRD+* may not aid the creative process. In fact, writers and scientists are among the product's most-enthusiastic users precisely because *PRD+* does not disrupt the creative process. *PRD+* allows users to

keep pace with their thoughts and type the same way they think, which is often with lab and technical abbreviations. Medical and legal transcriptionists tell us that they have doubled their incomes using *PRD+*.

PRD+ is taught in more than 3,000 schools. Version 3.0 will be released in English, Dutch, French, and German.

Jonathan Parks
Vice President
Productivity Software International Inc.
New York, New York

FAN OF ENVIRONMENTS

I just want to say how much I depend on Charles Petzold's *Environments* column in *PC Magazine*. I rely on his articles for support and advice in working with Presentation Manager programs. There really is no other place to learn about this new operating environment, and the fact that he makes himself so accessible to your readers makes Mr. Petzold quite an asset. I learned *Microsoft Windows* and Presentation Manager programming from him, and I look forward to learning much more in the future.

Trip Tucker
Orlando, Florida

CORRECTIONS & AMPLIFICATIONS

The latest version of Alan Freedman's *The Computer Glossary* (Advisor, *PC Magazine*, January 16, 1990) is the 1989 edition, not the 1988 edition.

The correct phone number for Synoptics Communications Inc. ("Building Workgroup Solutions: LAN Management Systems," *PC Magazine*, November 28, 1989) is (415) 960-1100. The correct toll-free phone number for Paperback Software (First Looks, *PC Magazine*, January 16, 1990) is (800) 255-3242. The correct toll-free phone number for Dataworld ("Speed to Burn: 22 of the Fastest 386s," *PC Magazine*, February 13, 1990) is (800) 736-3282.

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But since there are a couple of other companies out there making similar claims, you might want to read on.

To see if we can back it up.

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Although regularly backing up your data is time well spent, you don't want to spend any more time than you absolutely have to shuffling floppies and listening to grinding disk drives.



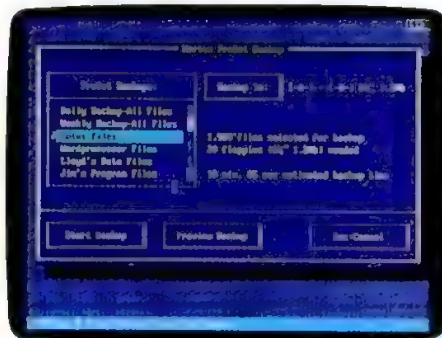
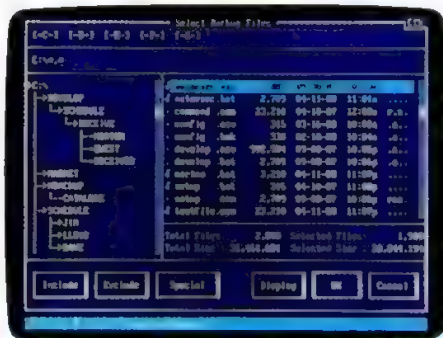
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disk control method that minimizes interruptions in the writing process.

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New tricks from the top dog.

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What you don't know can help you.

The Norton Backup loads at a keystroke and automatically configures itself to your particular

keystrokes.

Whichever interface you choose, you'll know *before* you start precisely how much time and how many floppies you'll need.

You won't need many floppies, because the Norton Backup packs the most data onto the fewest disk-

Namely the one between speed and safety.

Whether it's backing up, restoring or alerting you to file selection inconsistencies, the new Norton Backup is designed to be exceedingly reliable.

In fact, there's a patent



Backup and burn rubber. Our unique Fastpath™ technology makes us the fastest backup software on the market—up to 200% faster than the next fastest competitor.

system—no ponderous parameters to enter.

No complex syntaxes either. Because everything you need to know appears on your screen in highly organized pop-up windows.

Which means that saving—and restoring—everything from selected files to entire disks is as easy as point and shoot.

How often you point and shoot is up to you. Because the Norton Backup gives you a choice of three user interface levels.

(Not to mention five backup types, three levels of data verification, three levels of data compression and five display modes all the way up to 50 lines per screen.)

In fact, if you take advantage of our handy setup files, you—or someone on your staff who thinks backup is something you do with a gearshift—can execute the whole process in as little as three

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pending on our Distributed Error Correction, a remarkable feature that actually does something that others have only claimed to do—restore backed up data from severely damaged disks.

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You'll find the Norton Backup, the Norton Utilities and the critically-acclaimed Norton Commander® at your favorite software dealer.

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COMPUTING

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SOFTWARE AND THE LAW

(Hr) I work for a reinsurance company, where I do some programming in a 4GL language. If I were to distribute or sell a program to another company, would this be against the law, or would it just be against company policy? Is the program or system copyrighted against someone else's copying it? What if I write a program or system at home on my own time? Is there somewhere I could call or write to get a copy of software copyright law?

Steven Bonici

New York, New York



(Fep) Unless you're an attorney as well as a programmer, you might be better off tracking down a copy of M. J. Salone's *How to Copyright Software*, third edition (\$34.95; ISBN 0-87337-102-X; Nolo Press, 950 Parker St., Berkeley, CA 94710; (415) 549-1976), rather than trying to sort through the copyright laws on your own. Salone's book covers work that falls under the Copyright Act of 1976, which begins at Title 17, Section 101, of the *United States Code*.

The book provides an introduction to copyright law and guidelines for figuring out when you have the need and the right to register a copyright for a piece of code; it covers questions that arise in your case, such as who owns the rights to the programs you write as an employee of your firm. In addition, the book gives detailed instructions for registering a copyright and copies of the necessary forms.

You can also contact the U.S. Copyright Office (Library of Congress, Washington, D.C. 20559; (202) 479-0700) for answers to any questions that the book doesn't address.

SLOWING DOWN AND PLUGGING INTO A PS/2

(itm) I'm having problems running programs created for the 8-MHz environment on my new high-speed PS/2. Can I trick such a program into executing at a faster speed?

- **SOFTWARE AND THE LAW:**
When and how to copyright your programs.
- **SLOWING DOWN AND PLUGGING INTO A PS/2:**
Hobbling a fast system; mouse alternatives for the mouse port.
- **NO-STRETCH FORM FEED:**
Ejecting printer output without hitting the Form Feed button.

Also, can the mouse port on the PS/2 be used for other auxiliary-input devices—specifically, digitizing tablets and game controllers?

Doug D'Angelo

Sunnyvale, California



(FJP) In response to your first question, there are several utilities floating around that allow you to run speed-sensitive programs on a higher-speed machine. But rather than tricking the program into executing at a faster speed, these utilities trick the processor into wasting time. None of the programs I found were specifically written for or updated to work on a 386, but no problems arose in casual testing.

One such program is VARISLOW (a.k.a. VARISL.ARC), available on CompuServe in the GAMERS forum (Data Library 14) or the IBMHW forum (Data Library 5). After loading the program, you downshift the speed by pressing the left Shift key and upshift with the right Shift key; pressing both restores the machine to full speed. No documentation comes with the program, but it does include the commented assembler code, which

gives you a sense of how it works.

Another utility, SLOWDOWN, produces the same effect, but instead of using key combinations to up- or downshift, you enter a number between 0 and 65,535 as a parameter to indicate the degree of fastness or slowness you want. SLOWDOWN can be found in the UTILITIES database on PC MagNet (filename: SLOWDOWN.COM). If you don't have a modem, SLOWDOWN comes on the same disk as *ProChallenge Baseball*, a shareware game distributed by the PC-SIG (Disk #1207; \$6 for disk, \$24.95 for author registration; 1030 D E. Duane Ave., Sunnyvale, CA 94086; (800) 245-6717, (408) 730-9291).

Both programs operate by inserting instructionless loops during processor cycles, in effect making the processor wait before looking to the software for its next instruction. Thus, the machine runs more slowly for all applications, not just for those that are speed-sensitive. Although you can disable them, you can't unload either one from memory once installed.

If you need every byte of memory, I recommend that you use these programs in conjunction with MARK and RELEASE, two useful programs that are part of TurboPower Software's *TSR Utilities* (available in the UTILITIES forum on PC MagNet for connect charges only, or on-disk from the company for a \$10 time-and-hassle fee; 3109 Scotts Valley Dr., #122, Scotts Valley, CA 95066; (408) 438-8608; the filename on MagNet is TSR.COM25.ARC). You load MARK before the system-slows, then run RELEASE when you're done. All programs loaded after MARK get flushed from memory. For more information about the *TSR Utilities*, see the Advisor column in the August 1989 issue of *PC Magazine*.

Unfortunately, the news is not as good for non-rodent mouse-port use. The only peripherals that you can successfully plug into that port are input devices such as trackballs or keyboards—any device compatible with the Intel 8402 chip that

Advisor *(djmp)*

governs the port, according to the *IBM Personal System/2 Hardware Interface Technical Reference* (\$137; part number 68X2330; contact your nearest authorized IBM dealer; (800) IBM-7282).

However, the reasons why you can't use a joystick or a digitizing tablet in that port are vastly different.

Joysticks are analog, not digital, devices and can't be used with *any* serial port, much less a mouse port. A mouse operates by sending a message to the computer for every *mickey* (1/200th of an inch for a 200-dot-per-inch mouse) it moves in directions x and y. A mouse driver gets the mickey count from the hardware and moves the cursor a corresponding number of pixels.

When you push the lever of a joystick, on the other hand, a charge is sent out to resistors on a game card. The software, which talks directly to the game card rather than going through the BIOS or a driver, counts how long it takes for the resistor to charge; the lower the resistor,

the faster it charges, and vice versa.

A digitizer is a serial device and could conceivably work with the mouse port—as of yet, though, no one has designed one that does. The mouse port is a 6-pin version of a 9-pin serial port (or 9-pin bus mouse port), with the mouse electronics built into the motherboard. The digitizer's smarts are built into the unit itself. Plugging the digitizer into the mouse port (if you had the requisite adapter cable) would result in two sets of logic vying for control.

NO-STRETCH FORM FEED *(10/1sh)*

Is there a short program or utility available to provide a hotkey-invoked form feed to my HP LaserJet II? I often find there is less than a page of output being held in the printer buffer, and the only way I can obtain it is to manually reach over and hit the Form Feed button.

Bill Koehler
Austin, Texas



Although this problem most commonly occurs at the command line, such as when you COPY a file to the device PRN, it's a hassle that users of *Lotus 1-2-3* previous to Version

2.2 have been dealing with for quite a while. In addition, many programs *still* don't insert form feeds when they are printing.

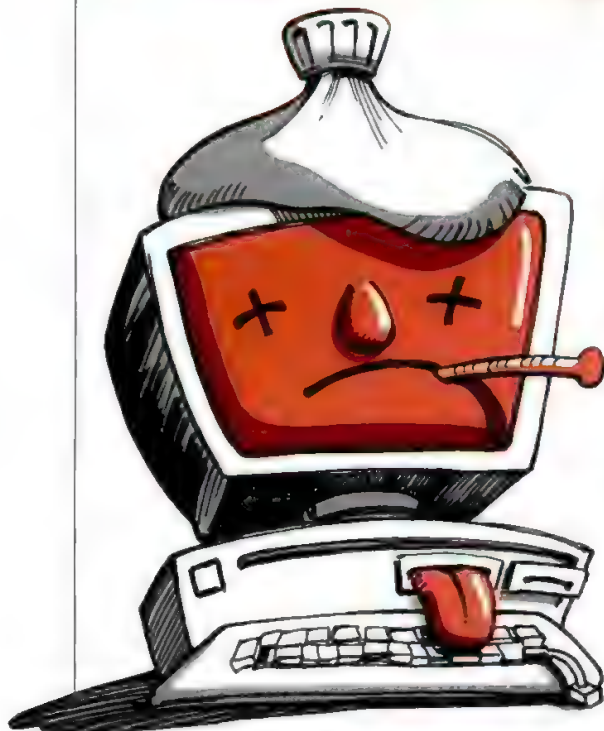
I solved the problem with *PC Magazine's* SETUP2, from the Utilities column of the May 30, 1989, issue (available on PC MagNet; filename: SETUP2.ARC). The program is a TSR which lets you define printer control strings to attach to each of ten function keys. You can create customized configuration files with frequently needed controls for different applications. SETUP2 takes up about 4K of RAM and can be unloaded at will.

In your case, for instance, you'd define F1 to send an ASCII 12 (Form Feed). After sending the print request, you'd hit Ctrl-RShift, then F1, to send the form feed to the printer.

ASK THE ADVISOR *(10/1sh)*

Send your questions to Advisor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column for access information). Please specify your equipment. ■

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PC Magazine, May 30, 1989

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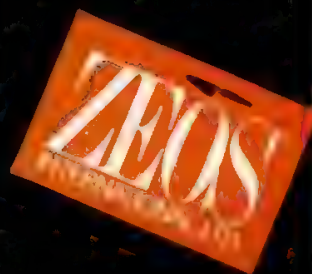
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First Looks

Hands-on Reviews of the Latest Products

Toshiba T1000XE, T1200XE Boast Best Displays Among Notebook PCs

HANDS ON
by Matt Jones

They just keep getting better. Laptops, that is. As if to answer complaints about the otherwise prodigious T1000SE's not accommodating a hard disk, Toshiba is now offering two downsize laptops that do: the 80C86-based T1000XE and the 286-based T1200XE.

FACT FILE

Toshiba T1000XE Toshiba T1200XE

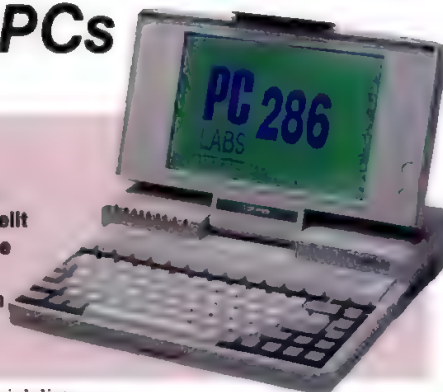
Toshiba America Inc., 9740 Irvine Blvd., Irvine, CA 92718; (724) 583-3000.

List Price: T1000XE, with 1MB RAM, 20MB hard disk, DOS 3.3 and Lap-Link in ROM, \$2,699; T1200XE, with 1MB RAM, 20MB hard disk, DOS 4.01, \$3,999; Internal 2,400-bps modem, \$349; additional battery packs, \$79; carrying case, \$99; numeric keypad, \$99; car adapter, \$129; external 3.5-inch 1.44MB floppy disk drive (for T1000XE only), \$249; external 5.25-inch 1.2MB floppy disk drive, \$499; 2MB RAM upgrade for T1000XE, \$1,199; 2MB RAM upgrade for T1200XE, \$1,099; external quick charger, \$349.

In Short: The 80C86-based T1000XE (6.2 lbs.) adds a 20MB hard disk to a machine very much like the Toshiba T1000SE but omits the floppy disk drive. The 12-MHz, 286-based T1200XE (7.78 lbs.) improves an excellent screen and adds numerous welcome features. Both machines boast wonderful keyboards and displays but suffer from a scant battery life of 2 hours.

CIRCLE 488 ON READER SERVICE CARD

The T1200XE's double-scan CGA display uses a sidelit design to conserve power while minimizing screen thickness.



The T1000XE, which lists at \$2,699 with a 20MB hard disk and 1MB of RAM, comes in about the same package as the \$1,699 T1000SE, including the same excellent screen. The \$3,999 T1200XE, unquestionably the new star of the Toshiba lineup, departs from the SE in numerous ways, the most notable being its 12-MHz 286 processor and even bigger, brighter screen.

Both models depend on the somewhat miraculous, 2.5-inch variety of hard disk to work their magic. Our evaluation unit, an early T1200XE, came with a 20MB Conner Peripherals drive that turned in an average random access time of 22 milliseconds on the PC Labs BIOS Seek test. Toshiba reports that it will ship units with the Conner Peripherals drive or with similar JVC or PrairieTek models, depending on which manufacturer offers the best price.

The best news about the T1000XE is its size and weight. The machine measures the same as the SE, 1.8 by 12.2 by 10 inches (HWD), and with its hard disk it weighs in at 6.2 pounds—only 5 ounces heavier than the SE.

The worst news helps to explain the best: Toshiba did away

with the internal floppy disk drive when it squeezed in the 20MB hard disk. To help offset the inconvenience, Toshiba added Lap-Link to ROM and built-in a dedicated floppy disk drive connector where the floppy drive had been. The connector accepts a \$249 3.5-inch floppy drive that draws its power from the power supply of the machine.

The only other noteworthy difference between the SE and the T1000XE is in the possible uses of their extended RAM. Like the NEC UltraLite, the SE compensates for its want of a hard disk by providing up to 2.4MB of battery-backed RAMdisk. The T1000XE makes room for the same 2MB of upgrade memory but does away with the nonvolatile RAMdisk. This can hardly be viewed as a serious problem, however, when you've got 20MB of truly nonvolatile storage at your disposal.

The T1200XE has the same general appearance as the T1000SE and XE, but close inspection shows that the chassis is somewhat different and the features somewhat improved.

The T1200XE measures a bit larger than its siblings—2 by



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12 by 11 inches (HWD)—and a good bit heavier. Complete with battery pack (the same .7-pound, snap-in nickel cadmium pack used in the T1000SE and XE) our evaluation unit weighed 7.78 pounds. Add the \$349 internal modem and AC adapter, and you're packing over 9 pounds.

While added bulk is never welcome, the features it brings are, at least in this case. For starters, the T1200XE comes complete with an internal floppy disk drive, the same 3.5-inch 1.44MB drive used in the SE. Along the back of the machine Toshiba added an external CGA monitor port to the collection, which includes the same expansion bus connector, serial port, and combination parallel/FDD port of the T1000SE. Toshiba also built in a jack for a \$99 external numeric keypad. Two well-marked hotkeys allow you to toggle between the internal and external display, but only one can be active at a time.

Other additions include a small but welcome handle,

CONTINUES ON PAGE 34

PHOTOGRAPH: THOM O'CONNOR

First Looks

T1000XE/T1200XE

CONTINUED FROM PAGE 33

which snaps into the chassis underneath the front edge of the machine, and two small legs toward the back of the machine, which extend to provide a more comfortable typing angle.

The most exciting improvement over the design of the SE is its double-scan CGA display. Instead of using EL backlighting—the technology used in the NEC UltraLite, the T1000SE and XE, and the Compaq LTE and LTE/286—the T1200XE incorporates a *sidelit* display. With the help of carefully placed reflectors, fluorescent tubes along the sides of the display take the place of EL back panels or fluorescent tubes placed directly behind the screen.

The primary impetus behind the change was to conserve power, while minimizing screen thickness; EL back panels consume more power than fluorescent tubes, but traditional fluorescent backlighting makes for thick displays. The *sidelit* screen allows the T1200XE to match the battery life of the T1000SE and XE, despite its more-power-hungry 286 processor and components. Our evaluation unit lasted for 1 hour and 58 minutes on the PC Labs Battery Rundown test, approximately the same result turned in by the T1000SE.

Fortunately, Toshiba's power-conservation measure also produces a welcome by-product or two. Simply put, the T1200XE unquestionably boasts the best screen going among machines anywhere near the notebook classification. The display is significantly brighter than any of the EL-backlit screens, including that of the SE, and the text is crisp and well formed. You can easily work on this machine for hours without growing at all frustrated with the quality of the display.

As a second, if not immediately realized, benefit of the fluorescent *sidelit* technology, the display should last longer than its EL-backlit counterparts. In general, EL back panels suffer

from a shorter life expectancy than fluorescent tubes.

The screen also measures a bit larger than that of the T1000SE and XE, about 7.8 inches wide and 4.9 inches high versus 7.5 and 4.8. Toshiba moved the contrast and brightness controls from the left side of the machine to a spot immediately to the right of the screen itself, making adjustments a bit more convenient.

As for the keyboard, aside from a few minute changes, Toshiba mercifully left the SE's design alone. A Toshiba spokesperson reports that the function keys are slightly wider and that key travel has been increased ever so slightly. Key layout is superb for a laptop, requiring little initial adjustment, and the relatively quiet key mechanism provides a comfortable, sure feel.

The T1200XE also maintains the SE's AutoResume feature. Unless deactivated by the system's PopUp configuration utility, AutoResume saves all information loaded into memory when you turn off the machine. When you turn on the system again, assuming you do so within a given amount of time, you'll be returned to the place where you left off, whether at the DOS prompt or in the middle of a spreadsheet. AutoResume saves your place when the machine runs out of battery power, whether you've deactivated AutoResume or not. Without the main battery fully charged and installed, AutoResume maintains your place for about 10 days. When fully dependent upon the internal, secondary nickel cadmium battery, AutoResume is good for about a day.

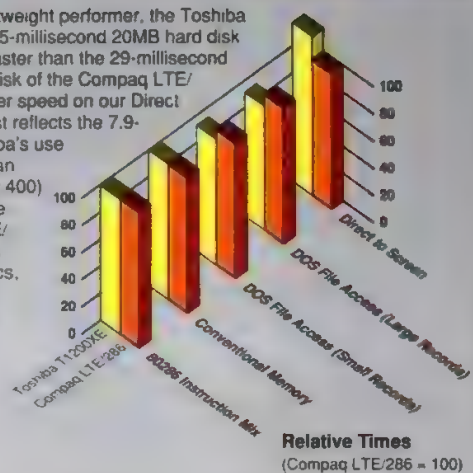
Other system utilities include various battery conservation routines, which shut down certain system components after a set period of inactivity. The PopUp utility allows you to configure inactivity periods or disable the automatic routines. Unlike the T1000SE and XE, the T1200XE does not include DOS in ROM.

The T1000XE and T1200XE each suffers from its share of failings. The T1000XE lacks a floppy disk drive, a



BENCHMARK TESTS: TOSHIBA T1200XE

Hardly a lightweight performer, the Toshiba T1200XE's 25-millisecond 20MB hard disk was visibly faster than the 29-millisecond 20MB hard disk of the Compaq LTE/286. Its slower speed on our Direct to Screen test reflects the 7.9-pound Toshiba's use of double scan CGA (640 by 400) graphics. The Compaq LTE/286 supports CGA graphics, with a resolution of 640 by 200.



The **80286 Instruction Mix** benchmark test times a series of tasks specific to the 80286 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.

The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at slower access speeds.

The **DOS File Access (Small Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk

caching. Fast times are advantageous for programs that work with many short segments of data.

The **DOS File Access (Large Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are

The **Direct to Screen** benchmark test indicates the speed of the video adapter memory. Good scores indicate that information can get to the screen quickly, particularly for programs that avoid the computer's BIOS and go directly to the screen.

Performance Times (Times given in seconds)	80286 Instruction Mix	Conventional Memory	DOS File Access (Small Records)	DOS File Access (Large Records)	Direct to Screen
Toshiba T1200XE	6.08	0.93	71.92	7.73	5.66
Compaq LTE/286	6.12	0.93	77.81	8.48	4.83

drawback that will ward off many prospective buyers. The T1200XE is a bit larger and heavier than seems fitting for a notebook laptop, about the same weight as the Compaq LTE/286 but a good bit larger. And, despite its size and 286 might, the T1200XE will not accommodate a math coprocessor, a limitation sure to drive more than a few buyers to the Compaq. Finally, the most serious drawback may be the 2-hour battery life—a meager store when compared with the conservative 3.5-hour rating of the LTE and LTE/286. For those willing to tote spares, Toshiba now offers a \$349 external quick charger that charges up to

three battery packs sequentially in 1.5 to 2 hours per pack.

All in all, however, these two latest Toshiba offerings, and especially the T1200XE, offer more than enough in virtues to offset their limitations. The excellent keyboard, wonderfully readable displays, and overall thoughtful design make them perhaps the most usable downsize machines on the market. Once merchants add the heavy discounts Toshiba products are known to carry, these machines are also likely to come at a bargain, at least compared with the Compaq LTE and LTE/286, which list at \$3,119 and \$4,619, when similarly equipped.

First Looks

QEMM-386 5.0: Finder of Lost RAM For 386 Systems

HANDS ON
by Edward Mendelson

Think of *QEMM-386* as the ultimate juice squeezer for an 80386 computer. Quarterdeck's \$99.95 memory manager for 80386 machines makes more RAM available for TSRs and expanded memory than you ever imagined finding in your machine. Version 5.0 now frees more DOS RAM than anything earlier and installs the most efficient possible configuration elaborately and automatically.

QEMM comes with a copy of *Manifest*, a utility that reports on the hardware and software configuration of your computer, and suggests ways of using your RAM most efficiently. *Manifest*, also sold separately at \$59.95, is probably the most detailed system analyzer on the market.

Like Qualitas's \$129.95 *386-to-the-Max Professional*, the new version of *QEMM-386* exploits the memory-management powers of the 80386. *QEMM-386* converts extended memory into LIM 4.0-compatible expanded memory. It loads device drivers and TSRs into high memory between the 640K top of DOS and the start of extended memory at 1,024K. It remaps slow BIOS ROMs into fast RAM. With Compaq, which often have duplicate copies of their BIOS ROM, it retrieves memory wasted by the redundant copy. It includes the functions of Microsoft's HIMEM.SYS, which adds to the RAM available to *Microsoft Windows*. And it's compatible with the Virtual Control Program Interface that coordinates programs like *Lotus 1-2-3*, Release 3.0, that use extended memory under DOS.

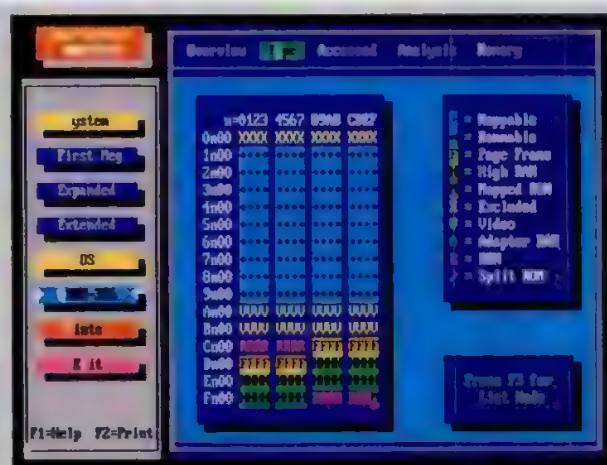
QEMM is unique in taking memory hogs like the FILES, FCBS, and LASTDRIVE commands from CONFIG.SYS, and wresting them away from

DOS memory and into high memory. Under DOS 3.x, it moves BUFFERS into high memory. (DOS 4.0 moves BUFFERS into expanded memory by itself). Other programs in the package optionally free RAM used by graphics cards and convert hardware-based expanded memory into extended memory.

QEMM's Optimize program automatically tests the RAM needed by TSRs and device drivers and calculates the most efficient way to shoehorn them into high memory. On my system it took a few seconds to analyze 20 million combinations

out unused areas in BIOS ROMs for use as high memory. The manual acknowledges that the program sometimes mistakenly occupies areas that should be left free when it tries this, and *QEMM* offers a command-line option to override the automatic function. With *386-to-the-Max*, an expert can access these BIOS regions by hand, because the program prefers to minimize the risk of adding them automatically. The result is that *QEMM* can sometimes access more RAM than *386-to-the-Max*, but at the risk of problems that can be difficult to sort out afterward.

Manifest, the system-analysis program, makes such problems easier to solve. It reports on your hardware, DOS, expanded and extended memory, and *QEMM-386* and *DESQview* if you have them running. It offers general overviews for the informed beginner and debugging data for experts. It bench-



Manifest, which is bundled with *QEMM-386* or sold separately, reports on memory either in graphic form (as shown) or in detailed tables, for debugging.

before writing a new CONFIG.SYS and AUTOEXEC.BAT that gave DOS 6K more memory than it had in the setup I worked out manually, and a total of 128K of TSRs in high memory. It preserved the original configuration files for safety. Unfortunately, it didn't offer me an opportunity to tell it in advance that some TSRs would work properly only in low memory, so I had to make some modifications by hand.

QEMM automatically seeks

mark-tests memory regions so that you can assign fast RAM where it will do the most good, and you can load it as a TSR to track down arcane conflicts that arise while other programs are running. When it's through with its tests, it presents detailed plans for modifying your configuration, and it's smart enough to spell out the reasons why you might prefer to ignore its suggestions.

The manual and display both warn you to run every applica-

**FACT FILE**

QEMM-386, Version 5.0
Quarterdeck Office Systems,
150 Pico Blvd., Santa Monica,
CA 90405; (213) 392-9851.
List Price: \$99.95 (includes
Manifest, available separately
for \$59.95).
Requires: 80386-based
computer, DOS 2.0 or later.
In Short: The most powerful
386 memory manager, but with
a potentially over-eager
installation program.

CIRCLE 442 ON READER SERVICE CARD

tion program you use before using *Manifest*'s most advanced memory analysis function. Take this warning seriously. If you don't, *Manifest* may tell you to make available to *QEMM* some memory addresses that a ROM BIOS needs, and the result could be intermittent errors or even data loss.

Around the time you read this review, Qualitas expects to ship *386-to-the-Max*, Version 5.0, with an automated installation procedure similar to that of *QEMM*, but offering more interactive options. The new version of *386-to-the-Max* will include most of *QEMM-386*'s RAM-grabbing functions, but it won't load LASTDRIVE, FILES, or FCBS into high memory, because, Qualitas argues, these functions are too closely dependent on the workings of existing DOS versions and might change without warning. One benefit of *386-to-the-Max* is easier access to tech support. Qualitas answers the phone and calls back quickly if necessary. I found Quarterdeck's technical support staff to be unreachable by phone for three days and was only able to get through by sending a fax.

QEMM-386 now offers more access to RAM plus the analytic tools of *Manifest* to make up for its more difficult access to tech support. But the inherent complexities of 386 memory managers make Qualitas's support worth considering when you choose which one to buy. Either package will make you wonder how you—and DOS—avoided RAM claustrophobia without it.

First Looks

Plus's HardCard II Crams 80MB of Storage in One Slot

HANDS ON
by Edward Mendelson

How do you squeeze 80 additional megabytes of disk storage into an AT or 386 machine that has all its drive bays filled? Simply push one of Plus Development's \$999 HardCard II 80 hard disks into a 16-bit expansion slot and run an automatic 1-minute installation program. If you have two slots free, you can plug in a second HardCard II 80 and get 160MB of storage. A 40MB model lists for \$849—too small a savings to justify choosing it instead of the 80MB version.

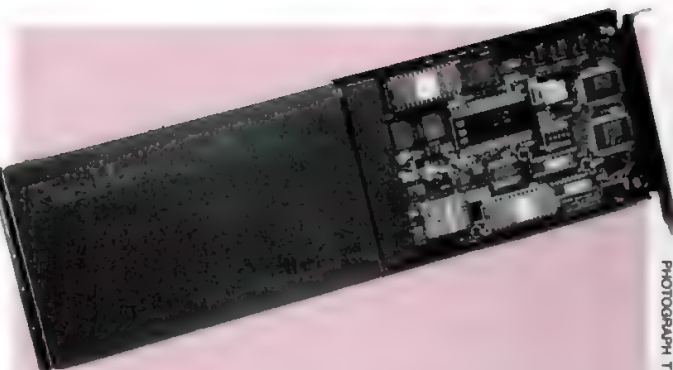
Plus Development's original HardCard for 8-bit PC-XT systems was the first—and by far the best—hard disk that fit on the same expansion card with its controller, for effortless and convenient installation. The HardCard II, for 16-bit systems, still fills only one slot, and this one adds unique features that make it even safer and faster than the original.

Safety first: if the controller detects that a sector with data on it is turning marginal, it automatically and transparently copies the data to a spare sector and locks out the marginal one. And for speed, the controller contains a 64K hardware cache, while the disk has a 1:1 interleave and a 19 ms access time. The disk works with OS/2 and networks and doesn't need to be COMPSURFed with Novell's NetWare.

The HardCard II 80 is both silent and fast; you can't hear it over the computer's fan noise except during disk access, when it makes a faint ticking sound. In PC Labs benchmark tests, the random BIOS Disk Seek test took 27.29 seconds and DOS Disk Seek 29.24 seconds, both about 1.5 times better than IBM's AT disk. The DOS File Access test for small records

measured 62.89 seconds, about 1.2 times faster, and large records 6.22 seconds, more than three times faster than the standard AT device.

The 100-g shock rating of the HardCard II 80 lets you use it as a portable backup device that can be moved from one computer to another. The package includes a backup utility that can transfer the contents of a physical disk with a single command. Switches let you select the BIOS address in case of conflicts. If you add a HardCard II to a system with a third-party ESDI drive, you'll probably



The Plus HardCard II 80 houses a 64K cache controller, and the disk has a 1:1 interleave and a 19 ms access time.

PHOTOGRAPH BY THOM O'CONNOR

have to change the address. The manual gives full explanation of the switches but could use some more-explicit warnings of possible conflicts. Tech support is toll-free, but you probably won't need it.

If you have an empty drive bay, there are cheaper ways to add 80MB to your computer,

but none is as effortless as plugging in a HardCard II. ■

List Price: HardCard II 80, \$999; HardCard II 40, \$849.

Requires: One 16-bit slot, DOS 3.0 or later. Plus Development, 1778 McCarthy Blvd., Milpitas, CA 95035-7421; (800) 624-5545, (408) 434-6900.

CIRCLE 443 ON READER SERVICE CARD

Commenting, Usage Stats Distinguish Disc Director

HANDS ON
by Lori Grunin

As hard disk drives grow, so does the need for a way to manage files and reorganize disk structure. Existing file-management utilities provide tools to address these problems but generally fall short at helping you recognize when your files have gotten out of control.

Disc Director, on the other hand, is intended to help optimize hard disk usage; while the \$79 utility performs many of the same branch, subdirectory, and file operations as its closest rival, *XtreePro Gold*, the program does more than just shuffle files and directories. For example, in addition to the usual statistics, such as file size and available disk space, *Disc Director* informs you how much of the disk is taken up by slack bytes—the space you're wasting with files that are smaller than cluster size. It also quickly compiles a list of duplicated files, which can mount alarmingly on a very large disk.

In addition, the package lets you add one-line comments to files and subdirectories and perform searches across comments. To work with subsets of files among directories, the program creates virtual directories, called Phantom directories, in which files can be grouped by criteria such as date, filename, or comment text. Thus, for example, you can create a Phantom directory of spreadsheet files from across your disk.

Although *Disc Director* excels at intradrive tasks, it needs a little work on interdrive operations. Most important, the program lacks the ability to simultaneously display the contents of two drives (or two subdirectories, for that matter); the right side of the screen is strictly for viewing file and disk information. This capability will be included in the next version, according to Athena Software.

Disc Director isn't a program you want to pop in and out of constantly—it takes a non-trivial amount of time to load, since it scans the drives on your

system at load time. But it does let you launch applications and load files, shrinking down to about 10K upon launch. Since this treads on DOS-shell territory, the ability to create a customized applications menu would be useful. The program lets you browse files, a capability that has become de rigueur in file-manipulation software, but displays them only in ASCII and hexadecimal. Also, if the file lacks carriage returns at the end of lines, *Disc Director* gets confused and displays only in hex.

For \$79, *Disc Director* certainly gives *XtreePro Gold* and its kin a run for their money. If you're trying to squeeze as much space as possible from your hard disk (and who isn't?) and haven't yet formed a file-manager allegiance, give *Disc Director* a go. ■

List Price: *Disc Director*, Version 1.04, \$79; network version, \$295. **Requires:** 416K RAM, DOS 2.0 or later. Network Version requires NetWare or MS-Net-compatible network. Athena Software, 4915 Twin Lakes Rd., #19, Boulder, CO 80301; (303) 666-9569, (303) 530-0693.

CIRCLE 431 ON READER SERVICE CARD

Scalable LaserJet Fonts for WordPerfect

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Gibraltar Souvienne University Ornate Oxford Rockland
Letter Gothic **Copperfield** Garamand Helvenica Condensed Carnegie
Baskerton Classic Typewriter Obelisk Gettysburg Futuri
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PC Paintbrush IV Plus: One-Stop Solution for Scanning and Retouching Jobs

HANDSON
by Lori Grunin

The latest in Z-Soft's line of paint products, *PC Paintbrush IV Plus* combines the painting tools of its low-end *PC Paintbrush IV* with the scanner and EMS support of the more expensive *Plus* line. The good news is that Z-Soft has integrated some welcome features into the \$199 package—a wider selection of scanning controls, several special-effects filters, an eyedropper that works in zoom mode, multilevel zoom modes, and .TIF support—that make it a powerful retouching tool.

PC Paintbrush IV Plus's easy-to-use scanning module can pretty much replace the basic software that comes with most scanners. You can run a quick prescan on the image to select a portion for scanning, choose a resolution of up to 300 dots per inch in 256 shades (of gray or color, depending on your scanner), and apply one of several half-tones. Images can be scanned in at 25 percent, 100 percent, or 200 percent of their original size.

Once input, you can alter the image using the Blend, Equalize, Mosaic, Sharpen, and Remove Spots filters.

In addition to the direct scanner controls, the zoom modes are the strongest features of the product; five zoom-in levels and six zoom-out levels provide real-time display of your alterations in a second window. The addition of the eyedropper to the zoom-in mode makes image retouching easier than with *PC Paintbrush IV*, but it would be easier still if the filled-box tool were also available for performing zoomed-in Blends and Smudges.

The bad news is that in addition to poor implementation of some of the new features, the package's paint tools suffer from the same deficiencies as *PC Paintbrush IV's*. For example, while the filters may be used with original graphics as well as with the scanned images, they can only be applied to an entire image. You have the option of previewing the result, but after taking many minutes (on a 16-MHz 386 with 4MB of software-emulated expanded

memory) to crunch through the relevant calculations, a dialog box asking if you'd like to effect the change immediately pops up over the preview image, obscuring a chunk of it. If you decide to go ahead with the change, the program then performs the calculations *again*. When smudging or blending, the program can be agonizingly slow, but the results are good. (The program does not support a math coprocessor.)

In addition, while the paint tools and palette controls may be satisfactory for the \$99.95 *PC Paintbrush IV*, they seemed insufficient in the twice-the-price *PC Paintbrush IV Plus*. You can't save gradients for fu-

ture use, and the program offers them only in vertical, horizontal, and radial orientations. The palette is the most logically presented I've seen in a paint program—all 256 colors displayed at the bottom of the screen, along with the selected foreground, background, and outline colors—but I'd like an easier way to mix colors for custom palettes.

If you've been kludging together applications to handle your scanning and retouching jobs, *PC Paintbrush IV Plus* is a recommended one-stop solution. Although its individual paint tools may be less powerful than some of the competition's, the nice set of effects—especially blending, smudging, and tiling—helps compensate. ■

List Price: *PC Paintbrush IV Plus*, \$199. **Requires:** 640K RAM, graphics adapter, hard disk drive, drawing device, DOS 3.0 or later. Z-Soft Corp., 450 Franklin Rd., #100, Marietta, GA 30067; (404) 428-0008.

CIRCLE 453 ON READER SERVICE CARD

4print Lets LaserJets Cram Four Pages into One

HANDSON
by Barry Simon

No doubt your word processor knows how to drive your laser printer, but how adept is it at handling all those ASCII files you have lying around? *4print*, a handy shareware utility from Korenthal Associates, will allow a Hewlett-Packard LaserJet or DeskJet to print those miscellaneous e-mail, READ.ME, documentation, and source-code files in compressed print sideways on a page.

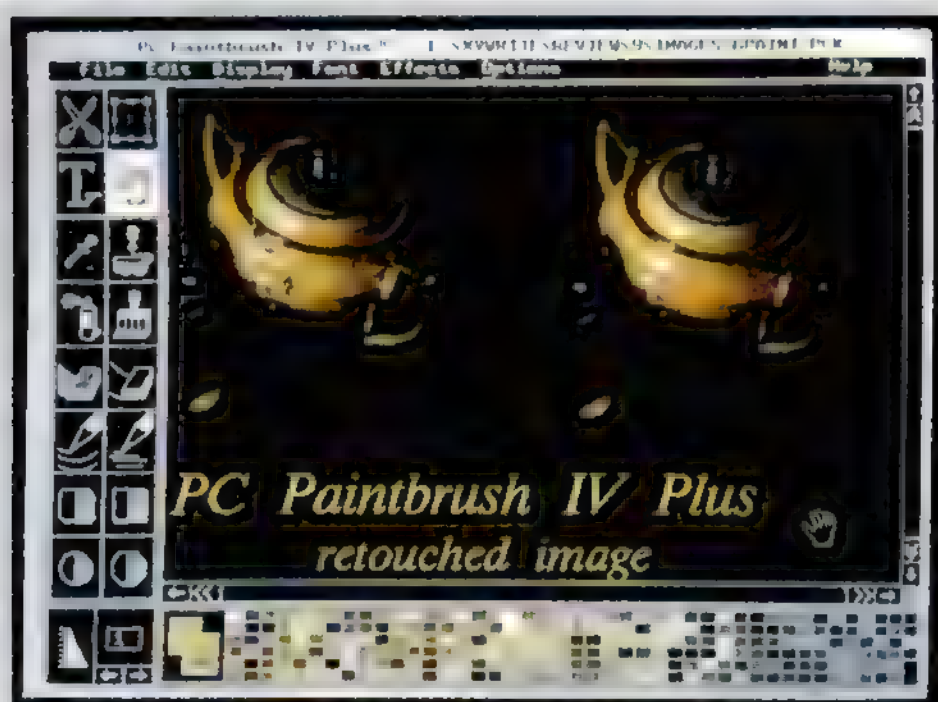
As its name suggests, *4print* will fit four standard pages onto one sheet in landscape mode if you use both sides of the paper, and will automate that process on the HP LaserJet Series IID. With a command-line switch, you can opt to print two standard pages on one side of a sheet.

The program has a lot of built-in intelligence. By default, *4print* uses the 8.5-point line printer font built into the LaserJet Series II, but you can

command the program to use a font cartridge or downloadable fonts. The program will frame text with bounding lines, giving your output a more elegant look. It allows you to add headers and footers that can include date, time, and filename. Sixty-six-line pages are not a problem for *4print*. Nor are the IBM graphics printer boldface codes, which the program can translate with ease. And the program's line-numbering option will be of interest to lawyers and programmers. At \$39.95, *4print* is definitely worth adding to your printer toolbox. ■

List Price: *4print*, Version 3.2, \$39.95. **Requires:** Hewlett-Packard DeskJet with landscape cartridge or LaserJet, LaserJet Plus, or LaserJet Series II or IID (LaserJet and LaserJet Plus require an appropriate font cartridge) or downloadable font. Korenthal Associates Inc., 230 West 13th St., New York, NY 10011; (212) 242-1790.

CIRCLE 444 ON READER SERVICE CARD



The image on the right is a retouched version of the one on the left; both have been blown up to twice their original size with *PC Paintbrush IV Plus*.

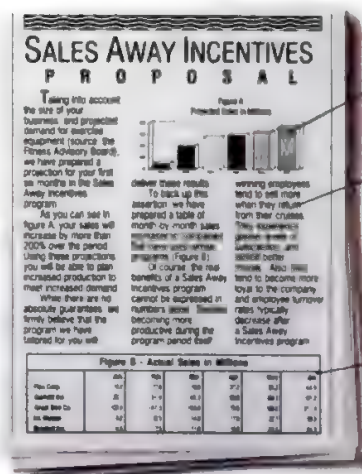
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Boise, ID.
"Paper handling."



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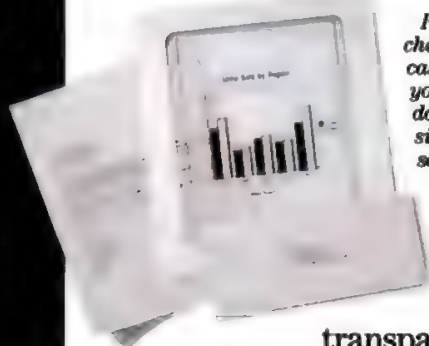
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First Looks

RoundTrip: \$695 4GL Integrates Spreadsheet Data with Other Apps

HANDSON
by Craig Simson

RoundTrip is a fourth-generation language for integrating spreadsheet applications with other components of a data processing environment. The \$695 program automates the interaction of .WKS, .WK1, and .WR1 files with *dBASE* files, other worksheets, ASCII files, and formatted reports.

RoundTrip can serve as a consolidation utility, translation tool, and report generator. You can use it to perform consolidations that would be error prone and time consuming even with the best file-linking spreadsheets available, to translate worksheets into formats required by mainframe record-keeping systems, and as a substitute for your spreadsheet's own macro language in generating multisheet reports, complete with aggregate calculations, subtotals, averages, and so on.

Just about any chore involving the movement of information in and out of worksheet files can be handled quickly and reliably by *RoundTrip*. And because the product is a full-blown programming language, it's ideal for repetitive operations—particularly those involving large numbers of disparate data sources.

The price of all this power is complexity. Users who are comfortable with other fourth-generation languages should feel at home with *RoundTrip*, but others whose experience is chiefly with spreadsheet design and macro programming may face a major learning hurdle. As programming languages go, *RoundTrip*'s is not especially complex, and the documentation is thorough and clear, but setting up procedures in *RoundTrip* is nothing like writing *Lo-*

tus macros.

You can interact with *RoundTrip* in either of two ways: by invoking a command interpreter and typing English-like statements at the RT prompt, or by creating command files in an ASCII text editor (not supplied). The former approach gives you immediate

syntax feedback and is fine for ad hoc report generation; the latter allows you to create interactive applications that can be run by anyone with modest spreadsheet skills. *RoundTrip*'s own ten-part menu-driven demo of itself serves as a model for creating command files.

Whether you're working at the RT prompt or with command files, you'll also need to create separate ASCII "master" files and worksheet "pattern" files. The master files describe the structure of your input sources, unless those sources are self-documenting (*dBASE* files and worksheet database files are self-documenting; most ASCII files, report files, and

nondatabase worksheets are not). The pattern files—.WK1 files containing a mix of labels, formulas, and special *RoundTrip* codes—are required whenever the output of an operation is to be a new worksheet; they tell *RoundTrip* where and how to put the incoming data.

At \$695, *RoundTrip* is a bargain—for those who need it. But for those who only occasionally need a data translation utility, it's massive overkill. ■

List Price: *RoundTrip*, Version 1.01, \$695. **Requires:** 256K RAM, DOS 2.0 or later. Circle Systems 1001 4th Ave., #3200, Seattle, WA 98154; (206) 682-3783.

CIRCLE 434 ON READER SERVICE CARD

Portex Professional Treads on SideKick Plus Turf

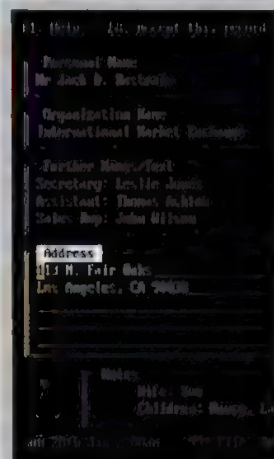
HANDSON
by Barry Simon

If you've outgrown *SideKick*'s bag of tricks but don't need *Agenda*'s project/idea organization magic, *Portex Professional* might be a useful alternative. More on the order of *SideKick Plus*, Eurosoft International's \$129.95 British import helps you organize your schedule, keep your to-do lists up to date, and manage addresses in either resident mode (taking about 70K of RAM) or nonresident mode.

While *Portex Professional* has a limited four-function calculator and a phone dialer, the program is really centered around three modules: an address book, a diary, and an editor. The address book accepts multiple phone numbers and addresses, so you can keep track of FAX numbers, car phone numbers, and vacation addresses, all for the same person.

The appointment module accepts recurring appointments. Since you can designate an item as "nagging" and have it carried over to the next day until acted upon, the program can be used to keep a rolling to-do list. Surprisingly, *Portex* has no alarms, a major shortcoming.

Portex's editor offers func-



An address book is one of *Portex Professional*'s three core modules.

tionality beyond that usually found in desktop managers. For example, the program can right-justify text and includes a spelling checker. But it is limited as a word processor, lacking support for proportional fonts or italics, among other things.

One of the program's strengths is how well integrated its modules are. For example, you can highlight an entry in the address book, hit Alt-P, hotkey to the editor, hit Alt-P again, and you'll get today's date and the name and address from the

address book pasted into your document.

Except for a stopwatch, the program's features do not act outside the program, even when it is running in resident mode. You cannot cut and paste or use the phone dialer from within an application screen as you might expect. *Portex*'s interface is slick, but its colors cannot be changed.

A stripped-down version of *Portex* is also available. *Portex Personal* (\$69.95) lacks the professional version's spelling checker, calculator, phone dialer, ability to run resident, encryption capability, keyboard macros, event logging, and laser printer support. Both versions have special support for pocket diaries.

Portex Professional won't take the PC industry by storm with a slew of innovative features, but it is well put together and useful. If you're interested in seeing what *SideKick Plus*'s competition has, take a look at *Portex Professional*. ■

List Price: *Portex Professional*, \$129.95; with leather binder, \$169.95; *Portex Personal*, \$69.95; with PVC binder, \$99.95. **Requires:** 320K RAM for *Portex Professional* (hard disk recommended); 256K RAM for *Portex Personal*; DOS 2.1 or later. Eurosoft International, 70 Woodfin Pl., #400, Asheville, NC 28801; (800) 678-7870, (704) 255-7590.

CIRCLE 446 ON READER SERVICE CARD

WorldPort 2496 Fax/Data Modem Takes Transmissions on the Road

HANDS ON
by M. David Stone

Whether you've reached the point where being away from a fax machine means being out of touch or you simply want to send or receive an occasional fax while on the road, you're likely to be interested in the \$699 WorldPort 2496 Fax/Data Modem from Touchbase Systems.

As the name implies, the 2496 is both a 2,400-bit-per-second standard modem and a 9,600-bps fax modem. Weighing in at just over 7 ounces complete with 9-volt battery, and measuring 2 1/16 inches by 4 7/8 inches by 1 inch, it's roughly the size, shape, and weight of a TV remote control. Even with the 12 1/2-inch serial cable and AC adapter that comes with the modem, the whole package still weighs in at barely 1 pound. And that makes it portable by any definition.

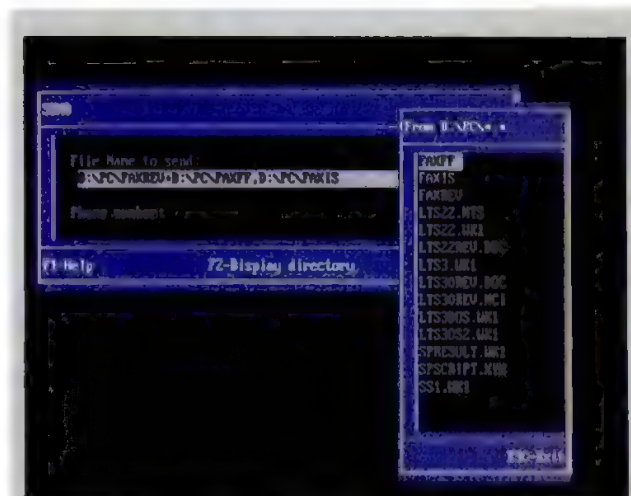
Except for size, the hardware side of the WorldPort package is unsurprising. The auto-dial, auto-answer data modem is billed as Hayes 2400-compatible, and in our tests it worked as advertised. Of its Group III fax modem, Touchbase Systems says there are no known incompatibilities with any Group III fax machines. Here, too, the fax modem worked in our tests as described for both sending and receiving.

The software accompanying the unit is notable for the Spartan quality of its menus, yet it offers all the capabilities you're likely to need. Among other features, it will automatically convert and send ASCII files and .PCX files, let you send multiple files with one command, and let you view incoming faxes on-screen and print them on a LaserJet II or Epson FX-compatible printer. It also

provides a phone book (limited only by disk space) and the ability to accommodate up to 16 distribution lists.

One nice touch is the package's integration of fax and data communications. For example, when the modem is set for auto-answer, it will establish connection with either a data modem or fax system. The software will automatically shift gears as well. Elsewhere on the menu, you'll find a simple terminal-emulation program.

The one oversight in this package is that the data modem lacks the newer error-correction and data compression protocols, such as MNP, V.42, and V.42bis. However, that's also still true of most modems, and it's a small price to pay for having the capability to send and re-



The software accompanying the WorldPort 2496 Fax/Data Modem is straightforward to use. In this Send screen, three files have been selected for transmission, and a fourth file is highlighted in the directory window.

ceive faxes. Just slip the WorldPort 2496 Fax/Data Modem into the same carrying case as your portable system, and you'll never be without fax capability again.

List Price: WorldPort 2496 Fax/Data Modem, \$699.

Requires: 512K RAM, serial port, DOS 2.1 or later. Hard disk

recommended. Graphics adapter card (CGA, EGA, VGA, or Hercules) required for viewing faxes. HP LaserJet II, Epson FX, or compatible printer required for printing faxes. Touchbase Systems Inc., 160 Laurel Ave., Northport, NY 11768; (516) 261-0423, (800) 541-0345.

CIRCLE 432 ON READER SERVICE CARD

BackLoader 2 Automates LaserJet Font Handling

HANDS ON
by Edward Mendelson

Load a copy of Roxxolid Corp.'s \$89 BackLoader 2 into your computer's memory, and you'll never have to think about whether your soft fonts are in your LaserJet or DeskJet's memory.

While BackLoader 2 lurks in RAM as a TSR, it waits for an application to send the printer a command to start using a soft font. When such a command appears, BackLoader interrupts and downloads the font so that the font reaches the printer before the command does. You can tell your applications that the fonts are permanently resident in the printer, just like car-

tridge fonts, and you can forget about writing batch files or macros to download fonts for you.

Because BackLoader keeps track of the fonts it downloads, it won't waste time downloading the same font twice. With Microsoft Windows and other applications that normally download soft fonts with each print job, the time savings can be noticeable.

Most LaserJets have limited internal memory for fonts or can't handle more than 32 fonts at once. When BackLoader detects that you're about to reach the limit, it tells the printer to clear the least recently used font from its memory and substitutes the one you need now.

When BackLoader 2 was first released, it occupied 29K of DOS memory—or 21K if you loaded a version that used a pop-up status line in place of a full pop-up menu. A new version will use expanded memory to reduce the bite taken out of memory to less than 10K.

In addition to its on-the-fly font fielding, BackLoader supports all standard download functions. It can send a predefined set of fonts to the printer when you start a session or let you select individual fonts to download from a pop-up screen. With applications that don't support soft fonts, you can insert two-letter control codes that BackLoader translates into commands to use soft fonts.

Most of these other functions are implemented awkwardly and use less-than-straightforward syntax. But BackLoader's automatic downloads are so transparent that you'll scarcely realize they're happening until you see the results on paper.

List Price: BackLoader 2, \$89.

Requires: 384K RAM; hard disk; LaserJet, DeskJet, or compatible printer; DOS 2.0 or later. Roxxolid Corp., 3345 Vincent Rd., Pleasant Hill, CA 95423; (415) 256-0105.

CIRCLE 441 ON READER SERVICE CARD

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Computer buyers guide and handbook

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"3X Link16 is an extremely cost effective, high speed zero-Slot Lan"

Doug Allinger/LAN Technology



As your stomach takes a long time to digest heavy meals, so do small workgroups with heavy LANs. Expensive and heavy LANs sold nowadays are hard to install, to use and maintain. They require qualified people and are not suitable for small workgroups.

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3X-Link16 is a small networking system that fits directly into the parallel port, between the computer and its printer, with no need to dedicate a port. 3X-Link 16 can be connected on PCs, PS/2 or Laptops without using a slot and opening the computer. Set-up couldn't be easier.

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Hot Wire: Disk Management, File Transfer, Modem Support in One Package

HANDS ON
By M. David Stone

Not long ago, disk management and direct-connect file transfer utilities were two separate categories. Today the distinction has almost disappeared.

Take Datastorm Technologies' *Hot Wire*. Coming from the developers of *ProComm Plus*, the popular communications package, you might expect the \$129 program's focus to be primarily on the transfer function. Guess again.

Load *Hot Wire* on one PC and the program shows you the tree structure of the currently logged disk. You can then move through the tree to another directory and use menu commands to create, remove, or rename a given directory or to log additional drives. With more than one drive logged, you can move from drive to drive using the plus and minus keys.

Two other modes let you split the screen to see both the tree and a list of files in the currently highlighted directory or the files in two directories at once. Both modes provide menus to let you copy, move, delete, view, and otherwise manipulate individual files or tagged groups of files. Of special note is a Global mode, which offers some sweeping, but potentially dangerous, capabilities. For example, there's a single command to remove all the files and subdirectories of a given directory.

Still other features let you shell out to DOS, define up to 24 function-key combinations for running programs directly from *Hot Wire*, and run any other program by highlighting it and choosing the run command. The price for this functionality is RAM: in all of these cases, *Hot Wire* ties up 177K.

Like most direct-connect file transfer programs, *Hot Wire*

treats the drive on a remote computer much like another drive on the local system. Connect two computers with the included *Hot Wire* null-modem cable, designate one system as the slave, and you can log on to the remote system's disk from the master computer's keyboard. You can then use *Hot Wire*'s disk-management commands to reorganize the slave disk and transfer files. The one limitation is that you can't run a program or access a data file from the slave.

A notable innovation in *Hot Wire* is the ability to link master and slave systems by modem. Enter the slave's phone number in the master's setup screen and the program will automatically



Hot Wire's split mode displays a list of files in two directories. A menu (shown on the bottom) is used for manipulating files.

dial and establish the link.

One potential source of confusion is that several important commands are on function keys, with the choices shown only in the help screen. However, this won't be a problem if you use *Hot Wire* frequently, but it makes the program harder to use for the occasional user

than it has to be.

List Price: *Hot Wire*, Version 1.00, \$129. **Requires:** 192K RAM, serial port on each computer for file transfers, DOS 2.0 or later. Datastorm Technologies Inc., P.O. Box 1471, Columbia, MO 65205; (314) 443-3282.

CIRCLE 448 ON READER SERVICE CARD

Info Select: Major Overhaul of Tornado Yields First-rate Low-end PIM

HANDS ON
by Jonathan Matzko

About a year ago, I reluctantly gave up *Tornado*, my favorite TSR notetaker, and switched to Chronologic Corp.'s *Instant Recall*. Despite its ease of use and unique windowing interface, I could no longer work within *Tornado*'s limitations. *Info Select*, a major *Tornado* upgrade, might win me back.

Tornado, which remains available, lacks some basic personal information management (PIM) features. It has no phone dialer, no calendar or scheduler, and no tickler feature.

Memory management was perhaps *Tornado*'s biggest weakness. I constantly ran up against the 50K limit on database size. And *Tornado*'s portly resident size, which can exceed 70K, made dealing with DOS's 640K RAM limit that much more difficult.

Info Select addresses all of

these sore spots, with excellent results on almost every count. Micro Logic bundles the \$99.95 PIM with a swap utility that squeezes the whole shebang into as little as 7K, albeit with some penalty in the time it takes to hotkey into the program. *Info Select*'s database size is limited only by memory (including EMS), so you'll never need to delete data before entering a crucial note or phone number. Individual notes, unfortunately, are still limited to 32K in size, which is about half of *Instant Recall*'s 65K limit.

The dialer picks up phone numbers from within any text note. If a note has more than one number in it, a tap of the Down Arrow key brings the dialer to each successive number. The dialer worked flawlessly with an external Hayes Smartmodem 2400 but wouldn't dial out through my allegedly Hayes-compatible internal modem.

The tickler function is a sim-

ple extension of *Tornado*'s text-search capability; you embed two asterisks and the desired date within a note and *Info Select* pops up the note on the requested date, either automatically at startup or when you manually poll the tickler.

Info Select's calendar function lacks the slick interface of *Instant Recall*'s calendar, but it is powerful enough to keep track of your appointments and flexible enough to allow you to maintain multiple calendars.

Info Select boasts much-improved word processing functions, including hypertext and mail-merge capabilities. Like *Tornado*, it's a great notetaker, but *Info Select* is also a first-rate low-end PIM.

List Price: *Info Select*, \$99.95. **Requires:** 256K RAM, DOS 2.0 or later. Micro Logic Corp., P.O. Box 70, 100 2nd St., Hackensack, NJ 07602; (212) 342-6518.

CIRCLE 449 ON READER SERVICE CARD



"Quicken slashed my tax preparation time and cost by 70%..."

—K.C. Branscomb, President, IntelliCorp

As tax time approached, I used to get this knot in my stomach. I'd dread getting all my receipts and records together for my accountant. I had this nagging fear that I couldn't find all my backup material. But not any more, thanks to Quicken.

It used to take me several weeks to prepare for my taxes. Now, with Quicken, I'm done in a few hours. And since Quicken does all the organization and calculations, pulling together the data for my personal Form 1040 and Schedules A, B, C and D is simple. What's more, my accountant's bill is 70% less because my Quicken records are so complete.

"When I was audited, Quicken saved me."

I used to worry about being audited. When it actually happened, boy was I nervous! Not because I'd done anything wrong, but because I knew I'd need very detailed records. So, I went into the audit armed with Quicken, both in reports and on my laptop. Sure enough, the IRS agent questioned every expense—every trip I took, every hotel room I stayed in. Thanks to Quicken, I responded to each inquiry quickly and easily. My accountant said that being so organized made

all the difference. And when the audit was over, it turned out the IRS owed me money!

"Quicken saves me time all year long."

I used to spend 3 to 4 hours every other Saturday writing checks and doing the books for my home and consulting business. Since discovering Quicken, I get the job done in just 30 minutes. All my frequent transactions are memorized on Quicken, so I just push a button...and Quicken writes, categorizes, and records my payments and deposits. It even prints checks for me. That frees up time for golf, skiing, and friends.

"Quicken automatically organizes personal and small business finances."

Before being president of IntelliCorp, I ran my own consulting business. So, I know how Quicken saves time with both personal and business finances. You just enter transactions, and Quicken automatically puts them in order and does the math. It captures your data in one place, and creates valuable reports like budgets and net worth statements in less than 3 seconds. For small businesses, Quicken creates P&Ls, Cash Flows, Balance Sheets, and other reports.

"I've tried others, but it's Quicken I recommend..."

I tried more expensive packages, but they took too long to get started. Then a friend recommended Quicken. It looks and works just like a paper checkbook. Quicken's so easy, I was up and running in 5 minutes—the payback was immediate.

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First Looks

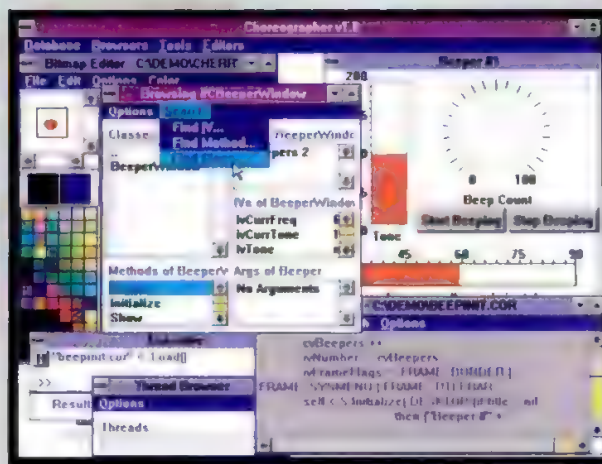
Using OOP, Choreographer Simplifies PM, Windows Applications Development

HANDS ON
by Richard Hale Snow

Attorning you the ability to re-define the desktop metaphor is the goal of *Choreographer*, GUIDance Technologies' \$7,500 object-oriented application development environment for the OS/2 Presentation Manager and *Microsoft Windows*. While you can develop *Choreographer* programs for either *Windows* or PM, the development environment currently runs only under PM.

Choreographer encourages this idea with a vengeance. The program doesn't prevent you from creating a conventional GUI desktop with multiple windows but instead lets you do even more: you can use it to build application-specific interfaces composed of objects that users will readily recognize. For example, a user might move icons that resemble manufactured goods around the screen to control an assembly line run by a *Choreographer* application; such icons would be defined to behave like the real items the user is familiar with. Since the *Choreographer* development environment doesn't require a programmer to be an expert in PM or *Windows* programming, anyone who is accomplished in C or Pascal can master it.

While *Choreographer*'s object-oriented programming (OOP) environment makes it easier to develop, implement, and maintain a GUI application, you can still take control of the underlying PM or *Windows* facilities and primitives. *Choreographer*'s approach to OOP is fairly standard: data and functions are stored together to form objects; once you define an object class you can create unique instances of the class. You communicate with an object by sending it a message, which causes a corresponding method to execute. The methods, like C functions, do the real work.



Choreographer's editor lets you create new interfaces by defining new object classes.

You can also create subclasses of objects that contain additional data and methods as well as inheriting the characteristics of the parent class. So while PM and *Windows* provide a number of windowing facilities and display object classes, *Choreographer* subclassifies these into standard components that can be more readily incorporated into an application. This makes building an application with *Choreographer* programming simpler and far less time-consuming than with PM or *Windows* programming.

Choreographer's Display Object Manager lets you create customized display objects that are neither rectangular nor window like. Each custom object can have more than one mouse region, and none is forced to reside in a single window (as it is in other PM development environments). *Choreographer* takes care of the connections between the object and the application code associated with it, then lets you test the object before adding it to the application.

Other *Choreographer* tools, like the BitMap Editor, are provided for specific tasks. A Class Browser lets you edit and in-

spect classes as well as display the hierarchical relationships between classes. An Instance Browser and Object Inspector display individual class instances and their contents. A File Manager helps manage class-library source files. And a Thread Manager graphically displays and controls the status of OS/2 threads. There's even an interactive debugger that opens up when an error occurs and lets you examine the object being used.

The *Choreographer* language, using an approach that facilitates OOP, resembles C but is syntactically simpler. For instance, you can specify that an object process a message in a new OS/2 thread. Access to low-level graphics and mouse primitives is available. With the *Choreographer* language, you can wire together screen objects or animate them. You can link objects and variables so that an object's appearance changes with the value of a variable. And you can create "action icons" that perform a specified action when they are covered by another object (for example, you can create a trash-can icon that deletes the file whose icon

is dragged to it).

The package includes over 70 class libraries. While these encapsulate and simplify the standard PM and *Windows* display classes, they also let you manipulate files, linked lists, OS/2 semaphores, and threads. There are additional classes for manipulating bitmaps, buttons, icons, scroll bars, and text windows. A DLL class lets you call and load any OS/2 DLL (you can use this to call your own C programs from *Choreographer*), and the *Choreographer* API lets you access *Choreographer* interfaces from C. GUIDance will soon release run time facilities as well as additional DLLs for SQL Server and LAN Manager support.

Although *Choreographer* isn't copy protected, you must attach a Software Sentinel adapter (included) to the parallel port of the machine on which it is run—not a hindrance, but an annoyance that we hope will be removed in the future.

Choreographer greatly simplifies the creation of customized PM and *Windows* applications with its OOP approach. If you're serious about OOP and want to develop GUI applications without the pain of learning PM and *Windows* programming, give *Choreographer* serious consideration. ■



FACT FILE

Choreographer, Version 1.0
GUIDance Technologies Inc.,
800 Vinial St., Pittsburgh, PA
15212; (412) 231-1300.

List Price: \$7,500 (\$5,500 for VARs).

Requires: 4MB RAM, EGA monitor, parallel port, Microsoft OS/2 1.1 or IBM OS/2 Standard Edition 1.1 or later.

Recommended: 6MB RAM, 2MB disk space, VGA/8514 monitor, 80386, mouse.

In Short: An exceptional environment for developing *Windows*- or PM-based GUI applications. Its object-oriented approach and programming language make it far easier to use than the underlying GUI technology. Not copy protected, but it requires a Software Sentinel attachment to run.

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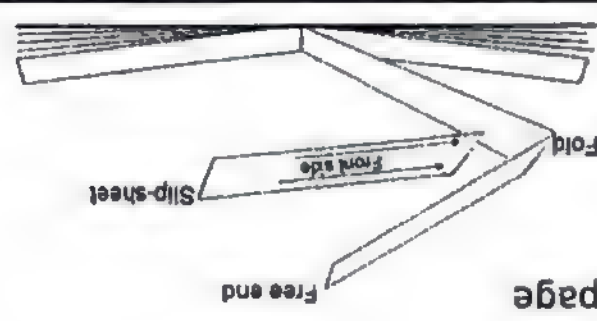
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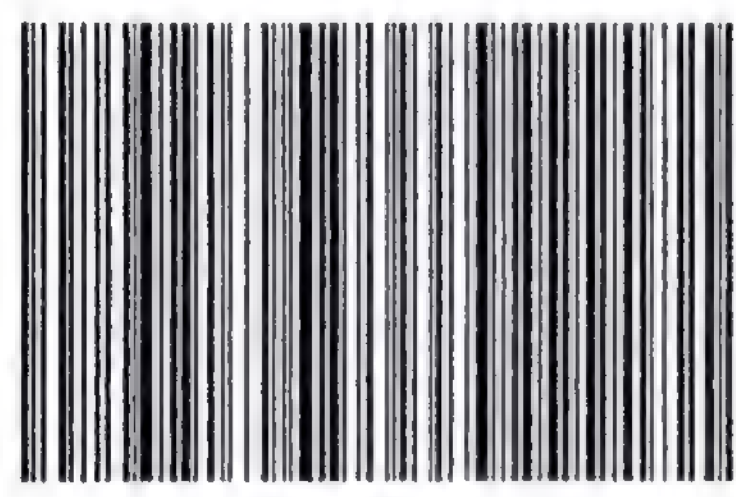
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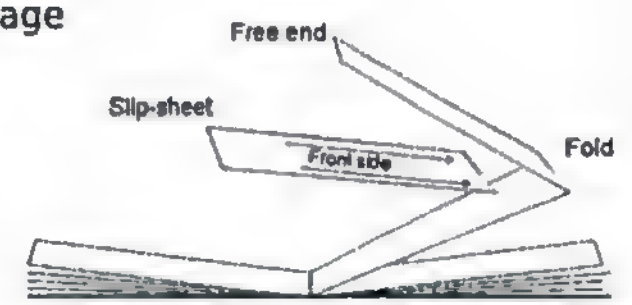


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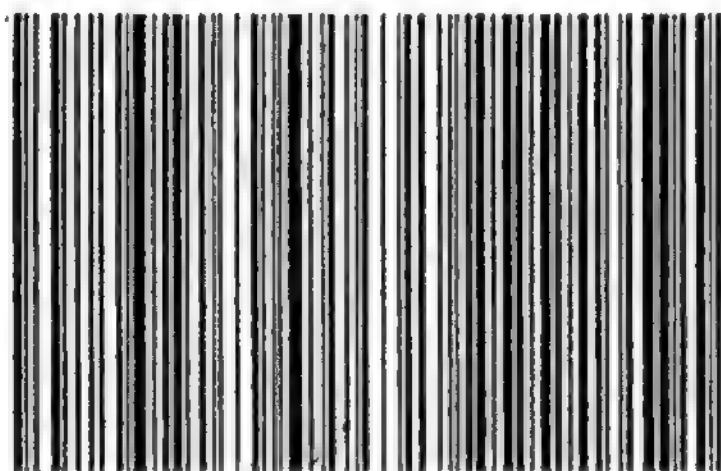
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Ralph Kissel, Senior Electronics Engineer

"We've standardized on Gateway 2000 systems in our department. Your prompt service and technical support has kept our sales operation running better than ever. Based on the quality and performance of your systems, I would strongly recommend them to other corporations."

Elizabeth Coyman, Director of Inside Sales
BYTE/McGraw-Hill



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First Looks

Erasable-Optical Drives: High Prices, High Capacities, Not-So-High Speeds

RANDOM
by C. G. Milligan

A tape storage system provides high capacity and removable media. But because it takes minutes to access a single file and requires tedious tape positioning, it usually serves as an archive device. A high-capacity hard disk drive offers speed. But since it's not removable, it can't secure sensitive data as effectively as you might like.

By combining removable media, storage capacities of over 600MB, and data access times similar to those of XT hard disk drives, erasable-optical (E-O) disk drives occupy a niche between high-capacity tapes and large hard disks. With typical list prices of \$5,000 to \$7,000, they are more expensive than either tape systems or LAN-server hard disks, but they're considerably faster than the former and provide two to six times as much storage as the latter. Devices like Pinnacle Micro's REO-650 (\$4,995 plus \$995 for interface kit), Advanced Graphics Applications' AGA Discus Rewritable (\$6,495), and Micro Design's LaserBank 600R (\$6,995) are perfectly suited to holding high-integrity master copies of application programs and database files and are also appropriate for fast, on-the-fly archiving of data.

The REO-650, AGA Discus, and LaserBank 600R use the same random data access architecture as floppy or hard disks, so data access is acceptably fast. Read operations are about as fast as those of a hard disk in an old XT, and write operations are also slower than those of today's typical hard disks. In each of the three devices, a laser uses its heat to write and its light to read the data on an E-O platter. Erasing is done with laser heat in the

presence of an intense magnetic field. The laser in each of these drives reads and writes to only one side of the disk at a time, requiring you to flip the disk over to access the data on the other side. Formatting each of these disks takes about 25 minutes, and each vendor provides software for partitioning the disks.

Each of the three models uses the Sony E-O drive, a 5.25-inch unit capable of internal or external mounting. The optical platter resides in a cartridge resembling a 3.5-inch floppy disk drive that has grown to 6.0 by 5.3 inches and has gained a long shutter door. Inside the cartridge is a 5-inch optical platter with two hard-coded sectors. All three of the disks we tested have two sector-formatting schemes: 512 bytes per sector and 1,024 bytes per sector. When formatted, the 512-byte-per-sector disks amount to 297MB per side, and are sold as 600MB disks. The 1,024-byte-per-sector disks format to 323MB per side, and are sold as 650MB disks. After writing, the expected life of E-O media is 10 years or more.

The software accompanying the AGA Discus and LaserBank 600R drives (both of which use SCSI interface cards) has patches to extend the DOS 3.x boundary to allow partitions as large as 322MB. Because of Compaq DOS 3.31 and DOS 4's 32-bit sector-numbering scheme, no patching is required to access partitions of up to 322MB.

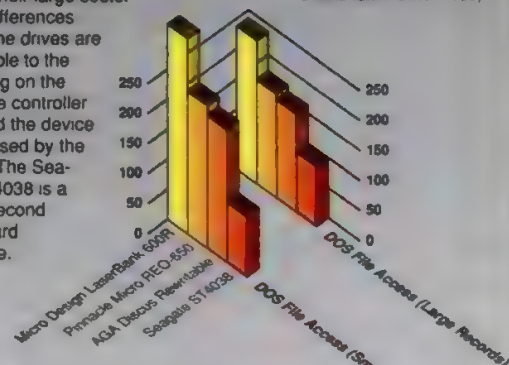
Each unit comes with menu-driven software: The LaserBank 600R's software performs installation, diagnostics, formatting, and partitioning. To these functions the REO-650 software adds password protection for the menu system and drive-door locking. The AGA Discus software has a confirmation of correct installation, in addition



BENCHMARK TESTS: ERASABLE OPTICAL DRIVES

The slow small-block-handling capability of these drives reflects their large sector sizes. Differences among the drives are attributable to the formatting on the disks, the controller card, and the device drivers used by the vendor. The Seagate ST4038 is a 28-millisecond 40MB hard disk drive.

Relative Times
(Seagate ST4038 in
8-MHz IBM PC AT = 100)



The DOS File Access (Small Records) benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.

The DOS File Access (Large Records) benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded.

Performance Times (Times given in seconds)	DOS File Access (Small Records)	DOS File Access (Large Records)
Micro Design LaserBank 600R	230.02	44.21
Pinnacle Micro REO-650	169.24	32.23
AGA Discus Rewritable	156.47	30.42
Seagate ST4038	71.03	18.64

to the four basics.

You can use all three E-O drives on network servers as well as with standalone PCs. Although it is possible to use an E-O drive as a shared network drive, its slow throughput (compared with that of a typical LAN server drive) makes it impractical to share among several workstations on more than a casual basis.

Although E-O drives present little competition for LAN server drives in terms of speed or for tape systems in terms of price, they win on security—if your company has instituted proper controls and procedures. Backup tapes are removable and transportable but also subject to erasure by airport X-ray machines and magnetic forces. E-O disks must be exposed simultaneously to intense laser heat and magnetism for destruction to occur, and they can be removed and locked away for safekeeping. They may be ex-

pensive, but then what value do you place on your data?

List Price: Pinnacle Micro REO-650, \$4,995; \$995 for interface kit. **Requires:** 128K RAM; Novell's *NetWare*, Version 2.15 or 3.0; DOS 3.2 or later. Pinnacle Micro, 15265 Alton Pkwy., Irvine, CA 92718; (800) 553-7070, (714) 727-3300.

CIRCLE 482 ON READER SERVICE CARD

List Price: AGA Discus Rewritable, \$6,495. **Requires:** 128K RAM, 8-bit SCSI adapter, DOS 3.x or later. Advanced Graphics Applications Inc., 90 Fifth Ave., New York, NY 10011-7696; (212) 337-4200.

CIRCLE 481 ON READER SERVICE CARD

List Price: LaserBank 600R, \$6,995. **Requires:** DOS 3.x or later, Novell's *NetWare*, Version 2.15 or 3.0, 128K RAM. Micro Design International Inc., 6985 University Blvd., Winter Park, FL 32792; (407) 677-8333; (800) 228-0891.

CIRCLE 480 ON READER SERVICE CARD

The Product Is Great, The Price



STANDARD SYSTEM 286/12 \$795

- INTEL 80286 12MHz CPU
- 1MB RAM (EXPANDABLE TO 8MB ON BOARD)
- AWARD BIOS
- ZERO WAIT STATE MEMORY ACCESS
- 384K SHADOW RAM
- 1:1 INTERLEAVE FLOPPY/HARD DISK CONTROLLER
- 1.2MB OR 1.44MB FLOPPY DRIVE
- 101-KEY TACTILE FEEDBACK KEYBOARD
- 2 SERIAL PORTS, 1 PARALLEL PORT AND 1 GAME PORT
- 8 EXPANSION SLOTS (2-8 BIT, 6-16 BIT)
- KEYBOARD SELECTABLE CPU SPEED
- REAL-TIME CLOCK/CALENDAR AND BATTERY
- SUPPORTS 80287 CO-PROCESSOR AT 10MHz OR 12MHz
- LIM EMS V.4 DRIVER INCLUDED
- 3 ACCESSIBLE 5¼" HALF-HEIGHT DRIVE BAYS
- 1 HIDDEN 3½" DRIVE BAY
- 200W POWER SUPPLY
- SYSTEM BOARD MADE IN U.S.A.
- FCC CLASS B APPROVED

SPECIAL FEATURE: THIS SYSTEM CAN BE UPGRADED TO A 386/SX USING CPU MODULE



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STANDARD SYSTEM 286/20 \$895

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- ZERO WAIT STATE MEMORY ACCESS
- 384K SHADOW RAM
- 1:1 INTERLEAVE FLOPPY/HARD DISK CONTROLLER
- 1.2MB OR 1.44MB FLOPPY DRIVE
- 101-KEY TACTILE FEEDBACK KEYBOARD
- 2 SERIAL PORTS, 1 PARALLEL PORT AND 1 GAME PORT
- 8 EXPANSION SLOTS (2-8 BIT, 6-16 BIT)
- KEYBOARD SELECTABLE CPU SPEED
- REAL-TIME CLOCK/CALENDAR AND BATTERY
- SUPPORTS INTEL 80287 CO-PROCESSOR AT 10MHz OR 12MHz
- LIM EMS V.4 DRIVER INCLUDED
- 3 ACCESSIBLE 5¼" HALF-HEIGHT DRIVE BAYS
- 1 HIDDEN 3½" DRIVE BAY
- 200W POWER SUPPLY
- SYSTEM BOARD MADE IN U.S.A.
- FCC CLASS B APPROVED

SPECIAL FEATURE: THIS SYSTEM CAN BE UPGRADED TO A 386/SX USING CPU MODULE



STANDARD SYSTEM 386/SX \$995

- INTEL 32-BIT 80386SX 16MHz CPU
- 1MB RAM (EXPANDABLE TO 8MB ON BOARD)
- AWARD BIOS
- ZERO WAIT STATE MEMORY ACCESS
- 384K SHADOW RAM
- 1:1 INTERLEAVE FLOPPY/HARD DISK CONTROLLER
- 1.2MB OR 1.44MB FLOPPY DRIVE
- 101-KEY TACTILE FEEDBACK KEYBOARD
- 2 SERIAL PORTS, 1 PARALLEL PORT AND 1 GAME PORT
- 8 EXPANSION SLOTS (2-8 BIT, 6-16 BIT)
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(Add Basic Price To The Monitor/Drive Combination Of Your Choice)

	MONO 720x348	VGA MONO 640x480	VGA COLOR 640x480	SUPER VGA 800x600	MULTISYNC VGA 1024x768
40MB MFM/28MS	\$ 470	\$ 620	\$ 850	\$ 975	\$1,100
66MB RLL/28MS	550	700	930	1,055	1,180
71MB MFM/28MS	770	920	1,150	1,275	1,400
100MB IDE/25MS	850	1,000	1,230	1,355	1,480
150MB ESDI/18MS	1,200	1,350	1,580	1,705	1,830
330MB ESDI/18MS	2,100	2,250	2,480	2,605	2,730

*Prices listed are available with complete system purchase only.

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File Server
LAN Workstations



STANDARD SYSTEM 386/20 \$1,295

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- AMI BIOS
- ZERO WAIT STATE MEMORY ACCESS
- 384K SHADOW RAM
- 1:1 INTERLEAVE FLOPPY/HARD DISK CONTROLLER
- 1.2MB OR 1.44MB FLOPPY DRIVE
- 101-KEY TACTILE FEEDBACK KEYBOARD
- 2 SERIAL PORTS, 1 PARALLEL PORT AND 1 GAME PORT
- 8 EXPANSION SLOTS (1-32 BIT, 2-8 BIT, 5-16 BIT)
- KEYBOARD SELECTABLE CPU SPEED
- REAL-TIME CLOCK/CALENDAR AND BATTERY
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STANDARD SYSTEM 386/25 \$1,495

- INTEL 80386 25MHz CPU
- 1MB RAM (EXPANDABLE TO 8MB ON BOARD)
- AMI BIOS
- ZERO WAIT STATE MEMORY ACCESS
- 384K SHADOW RAM
- 1:1 INTERLEAVE FLOPPY/HARD DISK CONTROLLER
- 1.2MB OR 1.44MB FLOPPY DRIVE
- 101-KEY TACTILE FEEDBACK KEYBOARD
- 2 SERIAL PORTS, 1 PARALLEL PORT AND 1 GAME PORT
- 8 EXPANSION SLOTS (1-32 BIT, 2-8 BIT, 5-16 BIT)
- KEYBOARD SELECTABLE CPU SPEED
- REAL-TIME CLOCK/CALENDAR AND BATTERY
- SUPPORTS INTEL 80387 CO-PROCESSOR
- 5 5/4" HALF-HEIGHT DRIVE BAYS
- 200W POWER SUPPLY
- FCC CLASS B APPROVED



STANDARD SYSTEM 386/33 \$2,595

- INTEL 80386 33MHz CPU
- 1MB RAM (EXPANDABLE TO 16MB ON BOARD)
- 32K CACHE MEMORY
- AMI BIOS
- ZERO WAIT STATE MEMORY ACCESS
- 384K SHADOW RAM
- 1:1 INTERLEAVE FLOPPY/HARD DISK CONTROLLER
- 1.2MB OR 1.44MB FLOPPY DRIVE
- 101-KEY TACTILE FEEDBACK KEYBOARD
- 2 SERIAL PORTS, 1 PARALLEL PORT AND 1 GAME PORT
- 8 EXPANSION SLOTS (1-32 BIT, 2-8 BIT, 5-16 BIT)
- KEYBOARD SELECTABLE CPU SPEED
- REAL-TIME CLOCK/CALENDAR AND BATTERY
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by
Matthew J. Ross

New & Improved

News of Announced Products and Upgrades

Taxan Ultra Vision 1150 21-inch Multiple Scanning Color Monitor

NEW

Following the example of the dual fixed-frequency NEC MultiSync 2A, Taxan has gone one better with its new Ultra Vision 1150. Accepting three different horizontal scan frequencies, the Ultra Vision 1150 covers all bases in this time of ever-changing video standards.

The Ultra Vision 1150 operates under three ranges of scanning frequencies, allowing users to choose from VGA, Super VGA, and IBM 8514/A; 1,024 by 768; and 1,280 by 1,024 resolution. Designed for CADD and computer graphics, the Ultra Vision 1150's 21-inch display can also display two full 8.5-by 11-inch pages for desktop publishing.

With its frequency ranges, the Ultra Vision 1150 is compatible with most analog

Taxan's Ultra Vision 1150 offers high-resolution graphics from VGA up to 1,280 by 1,024 pixels.



graphics boards operating at or above VGA, as well as the Macintosh SE 30 and Mac II. User controls on the front panel add flexibility and ease-of-use.

List Price: Ultra Vision 1150, \$4,095. Taxan USA Corp., 161 Nortech Pkwy., San Jose, CA 95134; (408) 946-3400.

CIRCLE 436 ON READER SERVICE CARD

HOT PROSPECT

VIEWFRAME RGB COLORS OFFICE PRESENTATIONS

nView Corp. incorporates VGA resolution and 16 true colors into its new LCD projection panel, the ViewFrame RGB. Operating as an electronic transparency, the ViewFrame RGB's 8- by 6-inch supertwist LCD works with all standard overhead projectors and is transparent to software.

The ViewFrame RGB features automatic fine-tuning controls. A removable control panel adds further focusing and color adjustments. The remote can also be programmed

to communicate macro commands to your PC. **List Price:** ViewFrame RGB, \$3,995. nView Corp., 11835 Canon Blvd., Newport News, VA 23606; (804) 873-1354.



With the ViewFrame RGB, leave your slides behind and give color presentations electronically.

CIRCLE 435 ON READER SERVICE CARD

DOS DDEX Allows Data Exchange with Windows Apps

NEW

A new development tool from Netlogic allows software developers to modify DOS programs to exchange data with Microsoft Windows applications over networks.

Using the standard Windows dynamic data exchange (DDE) protocol, DOS DDEX fools a Windows program into believing that it is communicating with another Windows application, when it is in fact talking to a DOS application.

You can link a DOS-based application like dBASE to a Microsoft Excel spreadsheet dynamically across any NetBIOS-compatible network. Changes made to the data file are reflected immediately in the spreadsheet. The DDEX functions allow a developer to modify DOS applications to permit real-time data sharing on a LAN without any network OS software. The package includes 27 ANSI C routines and sample source code.

List Price: DOS DDEX, \$1,795; \$2,995 for an unlimited license. Netlogic Inc., 232 W. 15th St., New York, NY 10011; (212) 989-5051.

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New & Improved

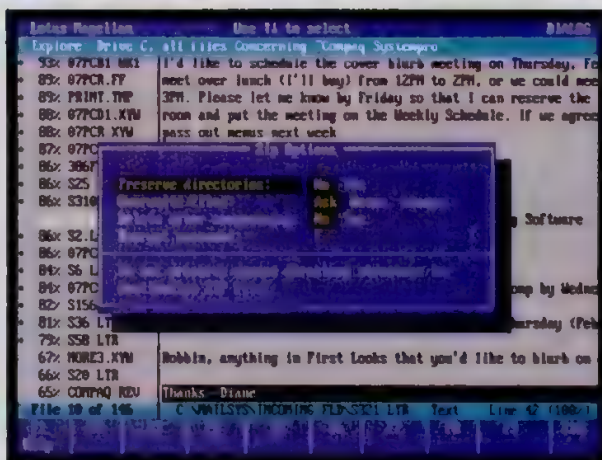
IMPROVED

Lotus Magellan, Version 2.0—Lotus Development Corp.'s powerful searching and viewing environment adds several new features, including the ability to edit ASCII text files, and to undelete, backup, and restore files.

Magellan's new Zip feature compresses files using ZIP compression and lets you search, view, and print the entire contents of any zipped file. A Verify feature checks file signatures for changes to guard against viruses. Lotus has expanded the list of file viewers with *AlphaWorks* database, *CompuServe* message, *Microsoft Excel*, *Lotus Freelance Plus* .DRW, *Framework II*, *Paradox*, *Professional Write*, *PFS:First Choice*, *Q&A Write*, *Quattro*, .PIC files, .PCX files, and *Lotus 1-2-3*, Release 3.0, file formats. The new editing capability allows Magellan users to edit ASCII text files or run an application and load the desired data file without having to return to DOS with the enhanced launch command.

Improved memory use has knocked 40K from the application, while users can now sort and view up to 32,000 files. Furthermore, Magellan can now be customized, including reassigning function keys with user-created macros and disabling the beeping sound. Release 2.0 of Magellan retails for \$195. Upgrades are available for \$39. Lotus Development Corp., Cambridge, Mass.; (800) 345-1043, (617) 577-8500.

Software Bridge, Version 4.1—The newest version of Systems Compatibility Corp.'s file conversion software now includes Macintosh conversions and a View feature that permits users to display the



Lotus Magellan offers several file-compression options with its new Zip feature.

utility boasts several new features, including a separate add-in for *Lotus 1-2-3* (Releases 2.0, 2.01, and 2.2) that allows 512K of previously unusable extended memory to be accessed as if it were expanded. In addition, it can free up to 96K of extra memory on systems with EGA and VGA adapters, move Novell network drivers into extended memory for an additional 36K of usable RAM, and provide extended memory spillover to the hard disk. *Above DISC 3.1* has a suggested retail price of \$119. Above Software Inc., Santa Anna, Calif.; (714) 545-1181.

Actor, Version 2.0—The enhanced release of the object-oriented development environment for *Microsoft Windows* now possesses an automatic memory-swapping feature, additional object-oriented fea-

CONTINUES ON PAGE 56

On dMAND Easily Generates Reports from dBASE Files

NEW

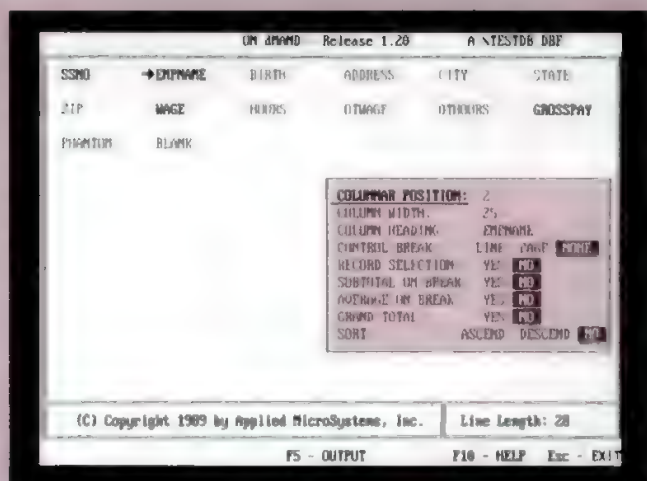
Now you can generate reports in a simple point-and-shoot environment with Applied MicroSystems' *On dMAND* software. This standalone program reads all *dBASE II, III, IV*, and *FoxBASE* .DBF files without a database manager, so that anyone with access to a given file can create a report quickly.

On dMAND can read records with as many as 254 fields. The software sorts up to 6,000 records, and you generate reports by selecting fields from the .DBF file. Reports and mailing labels may be previewed on-screen, printed, or saved as ASCII files. In addition, report-generating definitions can be saved for future use.

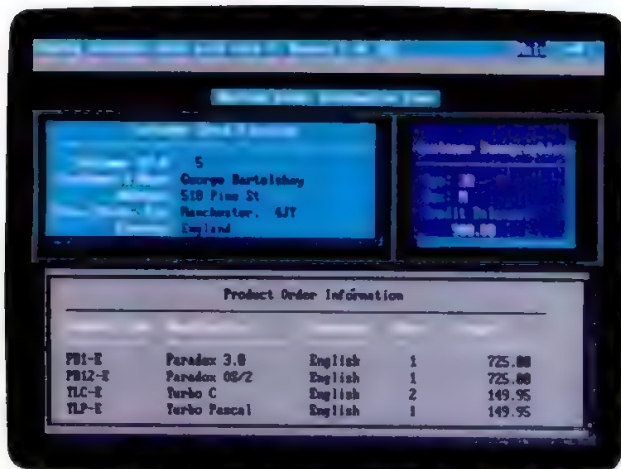
List Price: *On dMAND*, \$59.99. Applied MicroSystems Inc., P.O. Box 832, Roswell, GA 30077; (404) 475-0832.

CIRCLE 440 ON READER SERVICE CARD

On dMAND recognizes fields within any .DBF file for easy report generation. A pop-up window holds output column definitions.



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With Paradox 3.0, there are no Unclears, no Unknowns. You don't need an army of in-house technical support people. And best of all, you *don't have to be a programmer* to be a pro with Paradox. It's all gain, no pain.

✓ "Query-by-Example" for example

Use this checkmark and you're using QBE.

It's that easy. Let's say you need to know in a hurry which of your Los Angeles customers bought more than 5 pairs of white shoes. First ✓ the customer field, then type "LA," "white," and ">5," and you're done. Paradox gives you the right answer, right now. And how much programming to do all that? Zero.

If your database experience so far is limited to the flat-file type rather than relational, or even if a

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spreadsheet is the only program you've used before, Paradox gets you up and running immediately with just a ✓.

Record-locking and Auto-Refresh make the network safely network

Paradox has become the leading networker because it handles multiple users intelligently. If someone in your group or network has accessed a record, automatic record-locking keeps everyone else from changing it.

That way, two or more people can't change the same data at the same time. (As a bonus, Paradox also tells you *who* is using a record at a particular instant.)

Once the record has been changed by someone in the network, *Auto-Refresh* kicks in *automatically* and updates everything. Everyone in the network is looking at up-to-the-minute information.

Paradox, for the looks of things

Presentation-quality graphics are another Paradox distinction. They give you and your work the professional look.

Paradox instantly turns your tables into graphs with *one* keystroke—and in multiuser environments, with a few keystrokes your graph can show up-to-the-minute changes. Not only does everyone get the picture, they get an accurate picture.



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BORLAND

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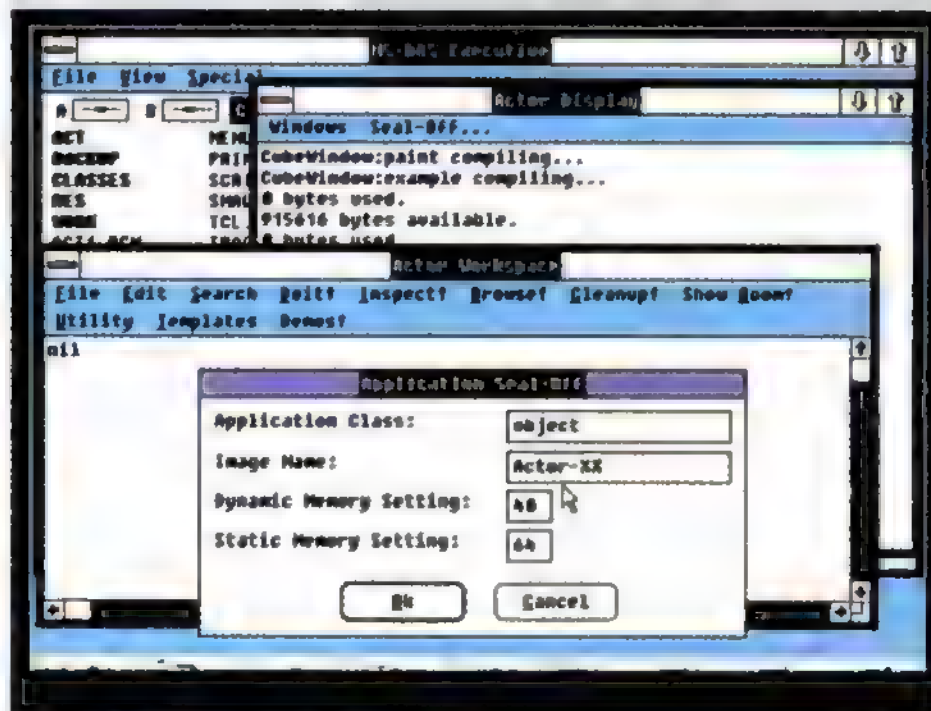
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New & Improved

IMPROVED

CONTINUED FROM PAGE 54

tures, and greater C compatibility. Using a least recently used (LRU) algorithm, Actor 2.0 swaps unused objects and code out to the hard disk, allowing developers to create applications that exceed 1MB, while still operating under DOS's 640K limit. Moreover, Actor 2.0 has added approximately 30 new predefined classes of code for windowing, graphics, and data management to aid software development. According to The Whitewater Group, the addition of ancestor binding, class variables, and class initialization increases the power and flexibility of the programming environment. Greater C compatibility allows developers to use user-defined primitive functions and dynamically linked libraries for faster program execution. Developers can also pass data to and from C routines with nested C structures. Actor 2.0 retails for \$695, with a \$149 upgrade available for registered users. The Whitewater Group Inc., Evanston Ill.; (708) 328-3800.



Actor 2.0 supports class variables for enhanced object-oriented software development.

ReadRight, Version 2.01—The enhanced release of the optical character recognition software from OCR Systems now recognizes draft-quality dot matrix text as well as scanned landscape documents. In addition, the software recognizes and preserves boldfaced, underlined, monospaced, and proportional fonts as well as page formats including multiple columns, justification, indents, and tabs. *ReadRight* 2.01 directly supports hand scanners such as the Logitech ScanMan and The Complete PC Half Page Scanner. *ReadRight* 2.01 can read pages wider than the hand scanner and then reconstruct an entire page in one output text file. Additional output formats include *Microsoft Word* 5.0 and *Microsoft Excel*, and *XyWrite*. *ReadRight* 2.01 retails for \$495, with a free upgrade from Version 2.0, or a \$99 upgrade for registered users of versions earlier than 2.0. OCR Systems Inc., Huntington Valley, Pa.; (215) 938-7465.

Invisible RAM—Invisible Software's latest release takes advantage of machines using the NEAT chip set from Chips and Technologies to provide EMS 4.0-compatible expanded memory. *Invisible RAM* frees untapped memory in 80286- and 80386-based PCs with 1MB RAM. In addition you can increase DOS memory by up to 224K by taking advantage of memory reserved for system shadowing. *Invisible RAM* allows users to store their memory-resident programs in the 224K above the 640K used by DOS. The new release of *Invisible RAM* retails for \$39.95. Invisible Software Inc., Foster City, Calif.; (415) 570-5967.

R-Selections Unlimited, Version 1.1—Grebar Systems' add-in query system for *R:BASE* now supports predefined expressions within queries and features dynamic column selection and sorting at runtime. A new "age" column-type automatically calculates age, seniority, or payment-overdue dates from your date column without clumsy arithmetic time functions. *R-Selections Unlimited* is written in *R:BASE*. It becomes part of your application, making it easy to output query results to your current forms and reports. The program is compatible with the new *R:BASE* compiler to create executable files, and all included macros come with source code for customization. *R-Selections Unlimited* retails for \$75 with a \$5 shipping fee in the U.S. Grebar Systems, Inc. Winnipeg, Canada; (204) 942-3301.

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	QUATTRO PRO*	Lotus 1-2-3* v 2.2 v 3.0	
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Built-in draw package	✓		
Individual cell font control	✓	✓	
Shading and borders	✓	✓	
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CONSOLIDATION			
Multiple spreadsheet windows	✓		✓
Multipage consolidation	✓		✓
Keyboard and mouse support	✓		
Lotus 1-2-3 v 2.01 compatibility	✓	✓	✓
Spreadsheet Capacity (NSTL) **			
640K RAM	11	8	NA
1Mb RAM	18	12	5
Price***	\$495	\$495	\$495

*Clip art from PicturePaks™ by Marketing Graphics Inc. (MGI)**NSTL (National Software Testing Labs) measured spreadsheet capacity by counting how many years of data could be added to a spreadsheet. Large numbers mean greater capacity. Performance for v 2.2 is with Airways attached. ***Based on suggested retail prices as of October, 1989.

"QUATTRO PRO seems to do the impossible: It maintains compatibility with 1-2-3; adds functionality that no version of 1-2-3 has and still runs large spreadsheets in 640K."

PC WEEK, September 4, 1989

"Borland squeezes such features as multipage consolidation, advanced linking, and live graphics into a package that runs on 512K systems with its Virtual Real-Time Object-Oriented Memory Manager (VROOMM) technology."

InfoWorld, September 4, 1989

QUATTRO PRO, with a unique balance of power, does both advanced publishing and multipage consolidation.

Lotus 1-2-3's Release 2.2 cannot do both. Neither can their Release 3.0 (see comparison chart).

QUATTRO PRO is compatible with 1-2-3.* It comes with a built-in draw package, clip art library,* and Bitstream® typefaces for presentation-quality output.

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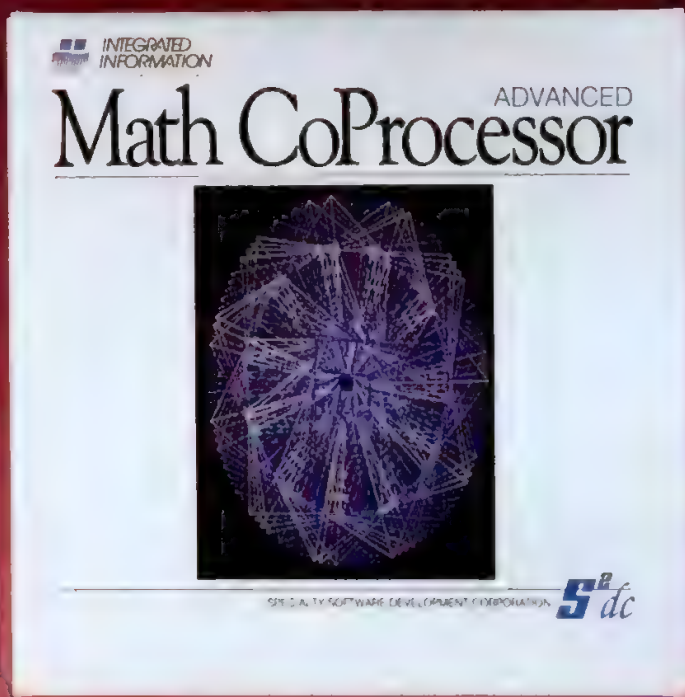
B O R L A N D

Code: MQ41

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New & Improved

Dolch Packs 486 Power in Lunchbox Portable

NEW

Dolch Computer Systems unveils its latest high-performance luggable PC, the Dolch P.A.C. 486-25, one of the first 486 portables to ship. Complete with 2MB of RAM (expandable to 16MB), a 5.25-inch high-density floppy disk drive or optional 1.44MB 3.5-inch drive, and a 100MB or 200MB hard disk inside its 9.5-by-16-by-7.8-inch case, the 20-pound Dolch P.A.C. 486-25 is designed for computation-intensive users on the go.

Featuring either a 640 by 400 double-scan CGA electroluminescent display or a VGA gas plasma display, with orange text or graphics against a black background, the Dolch P.A.C. 486-25 is suitable for CADD and desktop publishing. It also boasts an auto-switching 90/250V 200-watt power supply and three full-length, full-height 16-bit expansion slots, as well as built-in serial, parallel, and VGA monitor ports.

List Price: Dolch P.A.C. 486-25, with 2MB RAM, 100MB hard disk, 1.2MB floppy disk drive, VGA gas plasma display, \$13,590. Dolch Computer Systems, 2029 O'Toole Ave., San Jose, CA 95131; (800) 538-7506, (408) 435-1881.

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PC FormFAX Lets Users Create, Fill, And Fax Forms

NEW

PC FormFAX, a new utility from Commtech International, allows users to create forms up to ten screens long, input data into customized fields, and fax the finished product to one or more recipients, either fax machines or PCs with fax boards.

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List Price: PC FormFAX, \$89. Commtech International, 2580 Cumberland Pkwy., #150, Atlanta, GA 30339; (800) 678-8988, (404) 438-9999.

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Introducing Project Presentations Make Your First

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Take control by collapsing or expanding the outline structure to determine how much detail to show.

Customize Gantt charts with up to 16 data columns, from over 100 options. Gantt graphs automatically follow the on-screen legend.

Task Name	Start	Dur	1990	
	Date	Mths	Jun	Aug
PRODUCT DESIGN	2-Jul-90	4.3		
Market Research	2-Jul-90	3.4		
Evaluate Market	2-Jul-90	2		31-Aug
Focus Groups	20-Aug-90	1.1		24
Recommendations	24-Sep-90	0.8		
Specifications	4-Sep-90	2.3		
PRODUCT DEVELOPMENT	15-Nov-90	7.6		
Prototype	15-Nov-90	3		
Development	22-Feb-91	4		
Phase I	22-Feb-91	1.4		
Phase II	5-Apr-91	2.6		
Testing	29-Mar-91	3.6		
MANUFACTURING	12-Jan-91	3		
SHIP PRODUCT I	15-Sep-91	0		

Project Manager: Roger Collins

Marketing Manager: Sharon Richards

Use highlight colors for special schedule conditions, like resource problems, critical path, you name it.

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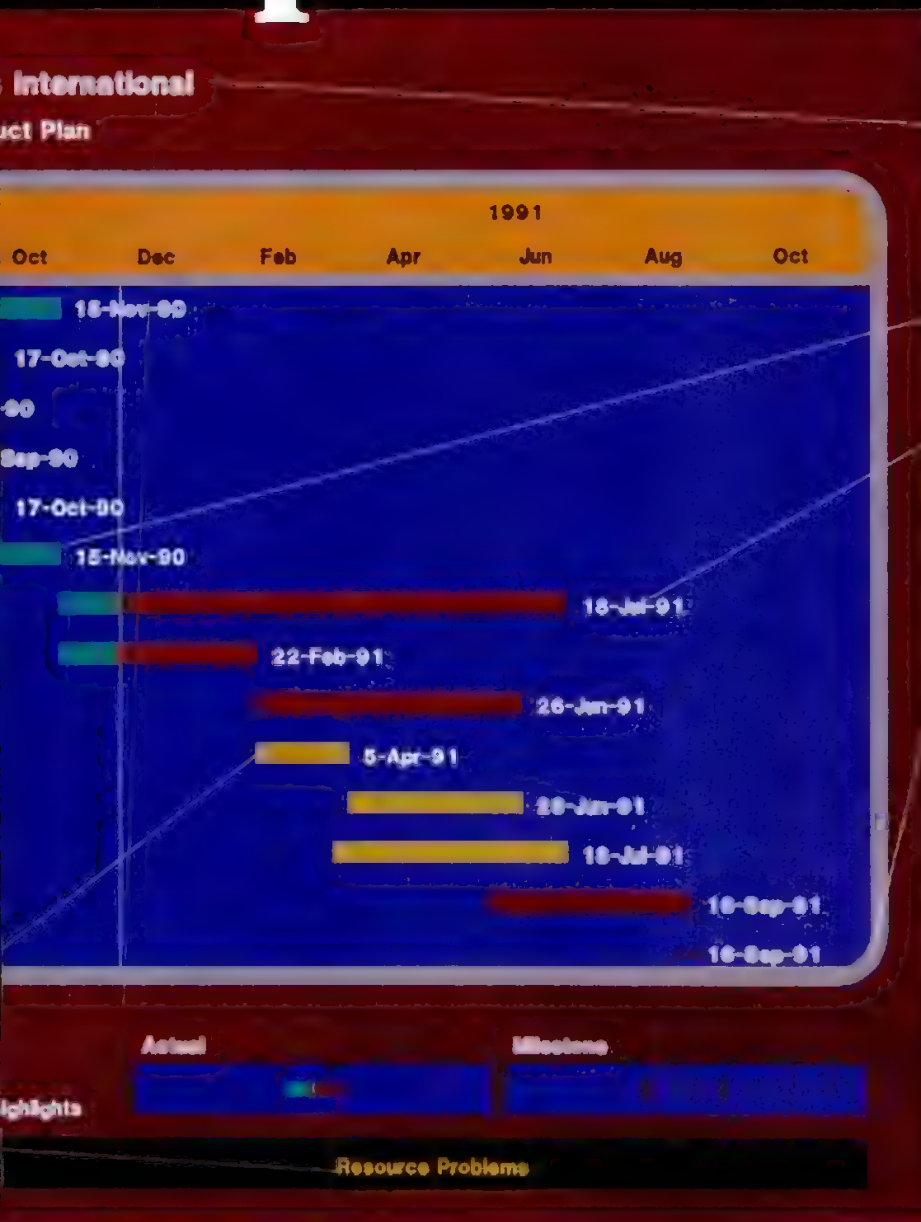


Symantec Corporation, 10201 Torre Avenue, Cupertino, CA 95014 408/253-9600

*Time Line received PC Magazine's Editor's Choice Award in 86, 87, and 88. It is also the #1 best-selling project manager. Survey of National Distributors... and received InfoWorld, Software Digest, and PC Week's highest 1988 ratings for project management programs. Training and consulting services available; call 415/898-1919. Time Line and Project Presentations are trademarks of Symantec Corporation. © 1990 Symantec Corporation

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A Sample of What's New.

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- ▶ Overheads, 35mm Slides

POWER:

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- ▶ Comprehensive Macros
- ▶ Faster Resource Leveling (Up To 50x)
- ▶ File Locking on LANs
- ▶ Export/Import (Lotus, dBASE, Excel, ASCII)
- ▶ Multi-Project Task Linking
- ▶ New Reports
- ▶ Traditional PERT
- ▶ Optional 50-Line Screen Mode
- ▶ Automatic WBS Generator
- ▶ Subset Schedule Extract

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- ▶ Spreadsheet-Like Edit
- ▶ QuickPlan & QuickGraph
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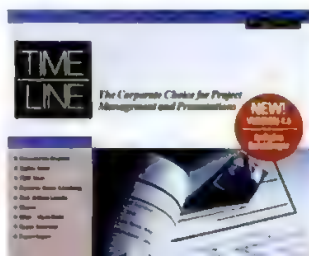
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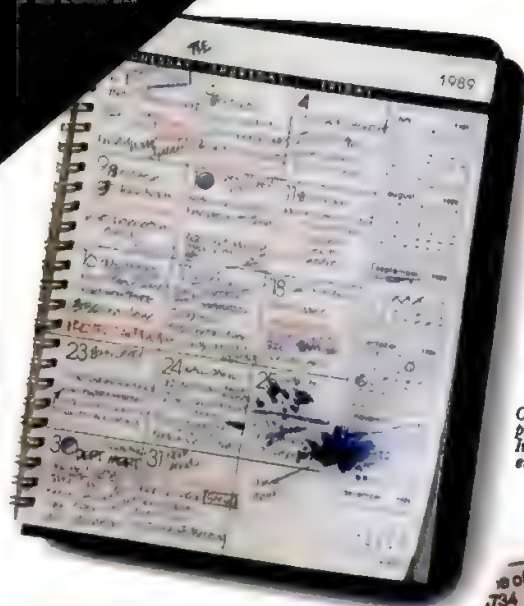
CIRCLE 264 ON READER SERVICE CARD

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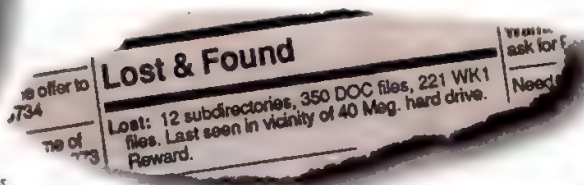


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CIRCLE 749 ON READER SERVICE CARD

by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

With RAM Chips at Lowest Prices in Years, Suppliers Plan New Fab Lines

If you've got extra RAM in your plans, the next few months may be the best time to stock up you'll have for a long while.

In January, several days after U.S. Memories, a consortium of American computer makers, abandoned its effort to create a domestic RAM supplier, key Japanese RAM chip makers

announced production cutbacks. Apparently, the prices are so low that these manufacturers aren't making enough profit from 256-kilobit and 1-megabit chips, and they believe now's the time to switch their investments toward developing potentially more-lucrative 4Mb and 6Mb chip lines.

As a result, by the end of 1990, 256Kb DRAMs are likely to become scarce and expensive; 1Mb chips are in such mainstream use that there will probably still be a healthy supply, though prices may rise from today's \$10-per-chip range if demand stays strong and no new production lines emerge.

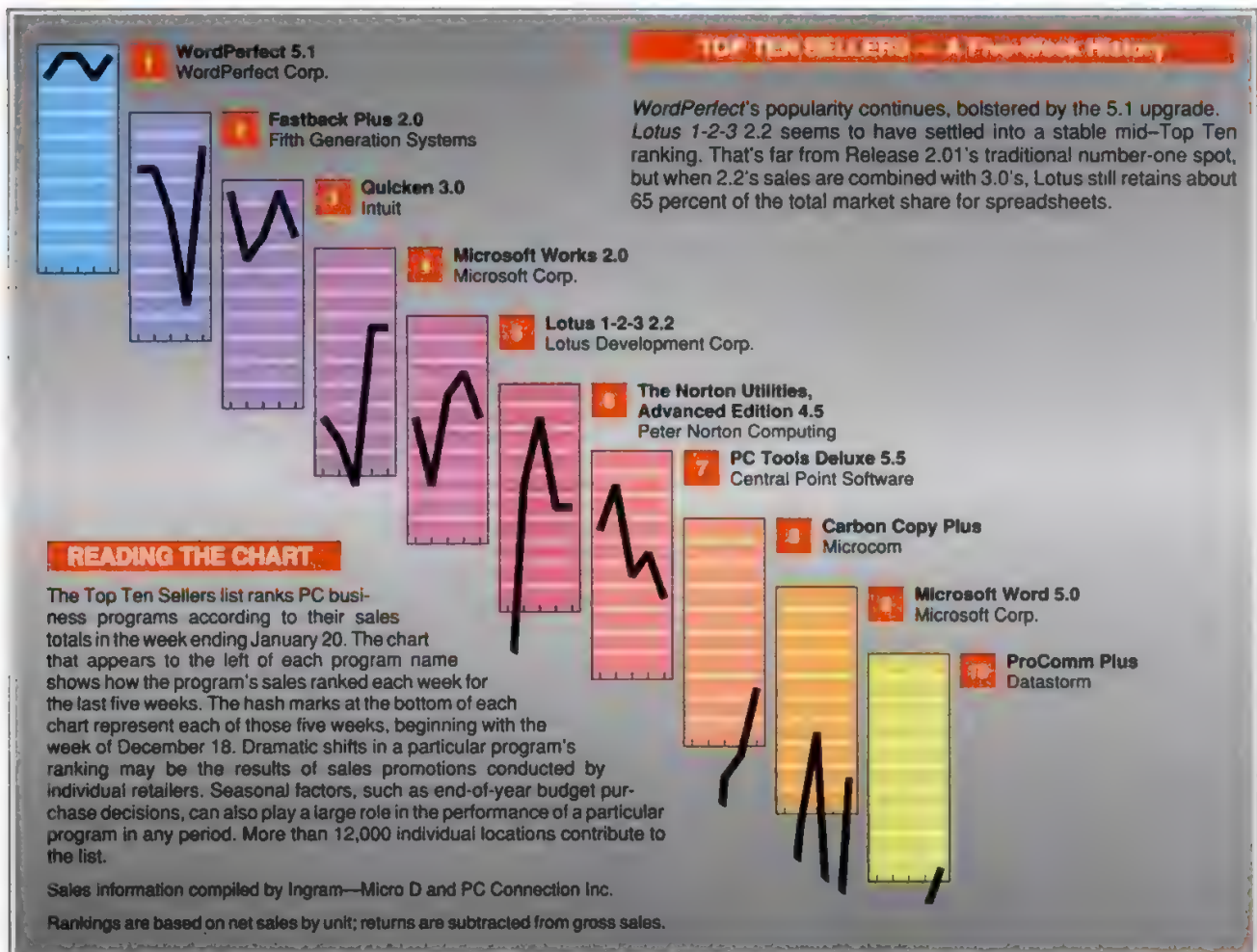
Sensing the potential shortfall, Intel took a partial step into a business that—in the past—it has said it does not want to be in. It will distribute chips made by NMB, a Japanese chip maker.

Intel has been meeting its

need for RAM by buying chips from Samsung. That contract is running out, and rather than continuing to be a middleman, Intel's taking a half step into the RAM-manufacturing business with this NMB partnership.

NMB approaches the chip business from a philosophy diametrically opposite from Intel's; it heavily automates production of basic designs. Intel emphasizes research and development of new designs and has steered away from ICs that are commodities.

CONTINUES ON PAGE 64



Pipeline

CONTINUED FROM PAGE 63

Rather than shifting gears to create the automated factories needed for efficient RAM production, Intel is entering into a partnership with NMB that gives the Japanese firm the job of making the chips and lets Intel take care of distribution.

Since Intel's true mission is to sell high-performance and high-profit innovative silicon and RAM is a simple low-profit technology, Intel is developing this relationship in order to help ensure that RAM supplies stay healthy.

While Intel is doing its best to help maintain supplies for current PC designs, IBM has entered into a cooperative agreement with Siemens of West Germany to develop 64-megabit chips.

The companies will contribute resources equally and will share marketing rights. The two hope to be selling these amazingly dense chips in four or five years.

Meanwhile, other U.S. computer manufacturers are still pinning their hopes for improving domestic RAM technology on Sematech, the consortium that's studying ways to improve high-density-RAM fabrication techniques.

dBASE Leads Market as Approval Ratings Slide

A pattern seems to be emerging in the foggy atmosphere of database standards. Ashton-Tate is slowly but steadily losing its podium as the sole source of PC database standards, but until recently there were few clear winners.

Fox Software is now well on its way to claiming the high ground of commercial systems developers, with its fast-acting *FoxBASE Plus*, and Borland has gained an edge in winning over corporations that develop lots of simple applications internally, with its *Paradox*.

One example of the kind of commercial development that *dBASE IV* is losing is SBT, the accounting software publisher

that built a software company around a *dBASE* application (it sells its accounting software as either executable code or *dBASE* source code; the source code outsells the compiled code nine to one). SBT now plans to switch to *FoxBASE Plus* for future releases.

Paradox's gains in end-user popularity were demonstrated in a study done by Techtel, an Emeryville, California, market research firm. It gave *Paradox* the highest rating among relational database managers when it queried buyers on whether they had positive or negative feelings about a product they had used. *Paradox* scored 91 in the company's 100-point system, and *R:BASE* was a distant second, with a 71 percent positive rating. *dBASE*, which once was the leader, rated a dismal 41.

Techtel found that *dBASE IV* still has a very high trial rate, far higher than the degree to which *Paradox* or *R:BASE* is being evaluated. But the feelings of users after they've made their evaluations spell difficult times for Ashton-Tate.

Still, *dBASE* is far and away the leader in database sales. Computer Intelligence, a market research firm based in La Jolla, California, reports that at the end of December 1989 the two versions had a combined market share of 72 percent: 37 percent for both *III* and *III Plus* and 35 percent for *IV*. (The figures are three-month averages for corporate purchases of relational databases.)

Ashton-Tate's problem is that as *dBASE IV*'s market share increases, *dBASE III* and *III Plus* lose market share, and *IV* isn't showing signs of becoming the dominant force that its predecessors were.

Meanwhile, *Paradox* showed steady growth throughout 1989, growing from 5 percent at the beginning of the year to 17 percent at year's end.

Ashton-Tate still has a chance to regain its lost ground; *dBASE IV*, Version 1.1, is nearing final testing.

Meanwhile, Microrim hopes to have a major impact later this year when it ships the first fully graphical relational DBMS for *Windows* and *OS/2*. ■

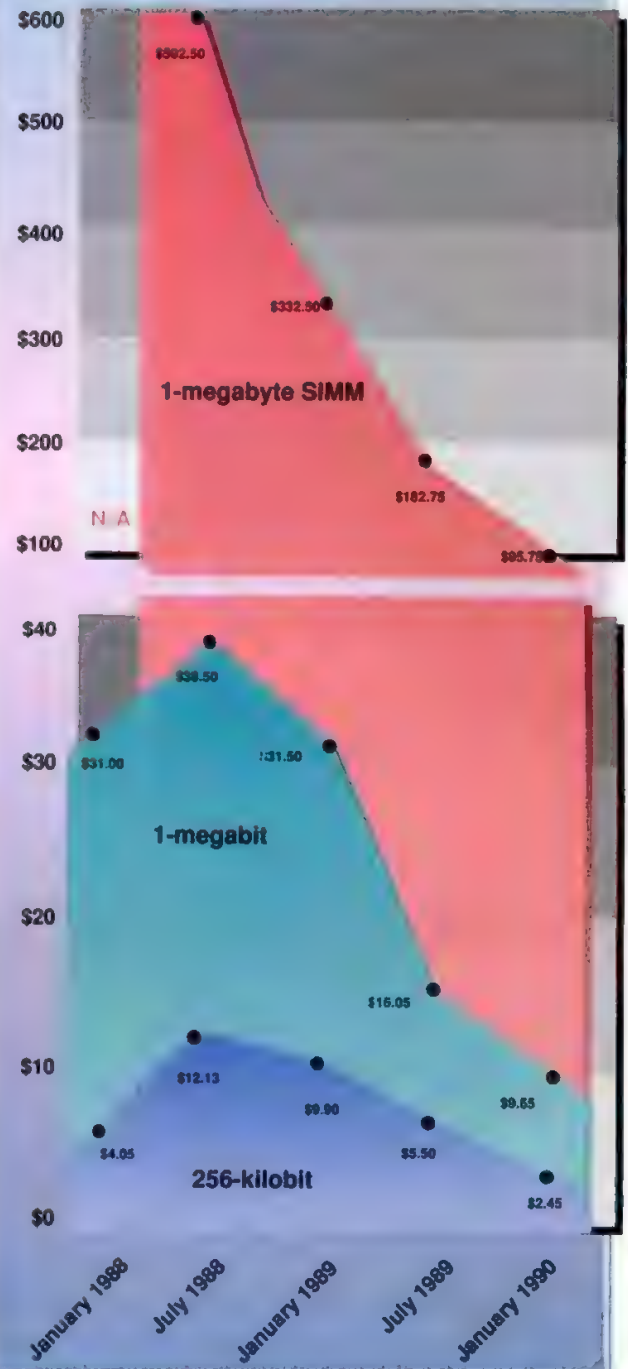
Have RAM Prices Bottomed Out?

The cost of the most popular forms of RAM is at the lowest level in years. The chart shows average advertised prices for 150-nanosecond 256-kilobit RAM chips, 100-nanosecond 1-megabit chips, and 100-nanosecond 1-megabyte SIMM packs from January 1988. One-megabyte SIMM packs weren't widely available in early 1988, and when they came out on the retail market in mid-1988, the cost was sky-high.

Note the surge in prices in mid-1988; current prices are well below those during the 1988 shortage.

These prices were for single-user-level purchases and don't reflect the volume discounts that corporations sometimes receive.

RAM Chip Prices Since 1988



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New FoxPro

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FoxPro is the first and *only* microcomputer database management system that combines astonishing performance with a sleek interface of amazing power and beauty.

- FoxPro offers all the elegance and accessibility of a graphic-style interface, yet operates at the stunning speeds possible only with character interfaces.
- FoxPro is so easy to learn and use, even beginners can become productive immediately; yet it's powerful and sophisticated enough to satisfy the needs of the most demanding developers and power-users.
- FoxPro gives you choices instead of limits: use a mouse or a keyboard; type commands or use the object-oriented interface; run in one window, or hundreds.
- FoxPro is so efficient, it runs in a 512K PC-XT, yet it's able to take advantage of the speed, expanded memory and extended video modes of the most advanced machines available. You don't even need a graphics card or special windowing software.



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Fox Software products are famous for their unmatched execution speed. FoxPro extends that tradition.

FoxPro is up to eight times faster than dBASE IV—more than 15 times faster than dBASE III PLUS!

And that blazing speed translates into unprecedented power. Now you can efficiently process gigantic databases with hundreds of thousands—even millions—of records.

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With FoxPro, your existing FoxBASE+ or dBASE III PLUS programs will run perfectly—first time, every time, no excuses. And FoxPro is language-compatible with dBASE IV. But FoxPro doesn't stop there. It has over 140 language enhancements not found in any version of dBASE. We've outdone ourselves by adding more than 200 language extensions you won't find in FoxBASE+.

Best of all, FoxPro opens up whole new worlds for your applications by letting you move them onto a variety of different platforms.

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Fox Software is committed to excellence—our products prove it.

We've been producing superb database management software since 1983. And our products for both the PC and the Macintosh continue to win awards worldwide.

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System Requirements: FoxPro operates in 512K RAM (640K recommended) with MS/PC-DOS 2.0 or greater and an 8086/8088, 80286 or 80386 microprocessor. For optimum performance, FoxPro takes complete advantage of any available EMS (expanded memory) or a math coprocessor.

Trademark (Owner): FoxPro, FoxBASE+ (Fox Software); dBASE III PLUS, dBASE IV (Ashton-Tate).

Fox Software

Nothing Runs Like The Fox.

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CIRCLE 112 ON READER SERVICE CARD

EP (electronic Page)

<feat> Bill Machrone



<ctxt>

I was having lunch with my friend Jon the other day. As ever, our conversation centered around the big players in the PC industry. Jon's an opinionated kind of guy, and he's notorious for asking rhetorical questions.

"How many hardware manufacturers," he asked, "can still command a premium price for their products?"

I try not to fall into too many traps when talking to Jon. I answered, "Two."

"Wrong," said he.

"So you think that IBM's direct sales and the fat discounts to big customers take IBM out of the running?"

"Right. Now what is it that lets Compaq keep the big list prices, the big margins, the big profits?"

Good question. And one that I didn't have a ready answer for. Sure, the fit and finish of Compaq products are second to none. And yes, Compaq has introduced some significant technological breakthroughs. But it isn't always at the state of the art. And while Compaq has resolutely held the line in supporting its dealers, its policy of funneling all support through dealers is frustrating to corporations and users who want direct factory support.

Yet the customers keep coming back. Our plan-to-buy research consistently shows Compaq coming in first or second in the high-end category. Compaq has a well-deserved reputation for quality and performance, but you can buy the same performance for less money. What keeps customers so loyal?

Yesterday, I unpacked a Compaq LTE/286 and gained an insight into the Compaq mystique. I've been unpacking and setting up Compaqs for years, but it had never struck me as forcefully before: attention to detail. I had borrowed a fully loaded LTE/286 from Compaq for evaluation. The folks at Compaq knew that I carry an NEC UltraLite every day and that I'm unstinting in my praise of it. They would like to see me carry an LTE (and Toshiba wants me to carry a T1000SE, Zenith wants...you get the idea).

The LTE came in four boxes. One held the machine and power supply, with a snug little nylon case to protect the machine against the insults of daily life. It also included a multi-

purpose screwdriver. In reviews I've been busting Compaq's chops for years about its use of Torx screws instead of the more-common Phillips-head variety. In the past, Compaq has included wrenches, but they were all too easy to lose. No danger of losing this puppy. It's a big screwdriver handle, emblazoned with the Compaq name. Unscrewing the top of the screwdriver reveals a variety of bits and heads that snap into the tool's shank. In fact, I have a virtually identical tool at home that proudly wears the Sears Craftsman logo.

NO PEANUTS

The second box held all the software and documentation (which wouldn't be remarkable, except that it weighed more than the machine). The third box contained the optional external 5.25-inch drive, and the last one contained the carrying case and a 12-volt adapter for automotive use. Nowhere in any of them did I find a single Styrofoam peanut. I didn't



ILLUSTRATION: LISA AMOROSO

even see any molded Styrofoam, with the attendant broken pieces and use-me-once level of packaging design. Instead, I found rugged, molded, high-density foam and thick, coated cardboard boxes that look as if they might last forever.

Nothing goes unremarked in Compaq's packaging. Nothing is taken for granted. Even the carrying case comes with its very own "Carrying Case Information Card," complete

<cs+> Leadership is tough to define. But Compaq provides a good working definition every day. It's all in the details.

<dump>
Bill Machrone

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Introducing New PopDropPLUS.

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Other so-called memory managers wastefully consume 50K or more for their code plus a swap area equal in size to your largest RAM-resident program.

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Load Up To 50 RAM-Resident Programs Into Expanded Memory.

This ingenious breakthrough in memory management allows you maximum flexibility in managing your memory—without interfering with the applications you have loaded and running in conventional memory.

System Requirements IBM PC, XT, AT, PS/2 compatibles Requires just 27K. Requires LIM 4.0 expanded memory hardware.

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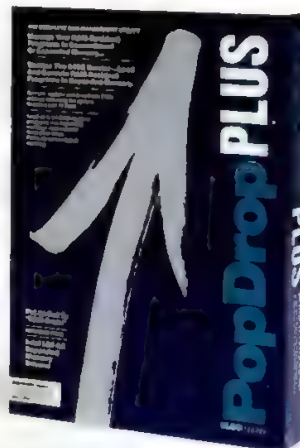
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Includes—FREE!
LIM 4.0 Drivers From Intel!

with illustrations, which tells you what the case is for and how to use it. It's not that the designers assume you are too dumb to figure out how to use the carrying case. They just leave no stone unturned. And that's worth paying for.

SOMETHING FOR EVERYBODY

Covering the basics in the documentation is critical to inexperienced users' acceptance of a product. It's also important to the dealer channel on which Compaq relies utterly for support. There's no 24-hour hot line for answering user questions, and there is a practical limit to the number of times you can ask your salesperson or the tech support group for help, so the documentation has to be good.

It's equally important to have features that advanced users can appreciate too, beyond the subliminal feel of quality that comes with the packaging, printing, and accessories. With Compaq, this comes in the form of utility programs. A variety of installation and setup utilities allow advanced users to tune the machine to their way of working. They can bias the machine toward heavy disk caching, maximum power conservation, expanded memory, RAMdisks, or any combination of the above.

Yet there's simplicity in this complexity. If you were so inclined, you could use EDLIN to change your AUTOEXEC and CONFIG.SYS files. But you'd be crazy not to use Compaq's Faststart program, which helps you configure your system and install device drivers. It makes EDLIN look positively Stone Age as it intelligently edits CONFIG.SYS. It knows enough about the Compaq-supplied device drivers to put up both an edit window and a help window that describes command-line options. The documentation's great, but it's even better when you don't need it at all.

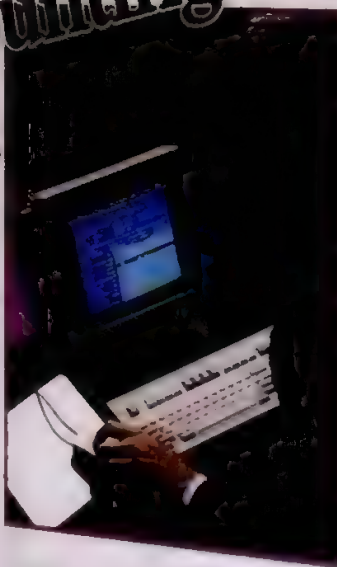
Other systems come with impressive documentation. IBM's is terrific. Other systems come with comprehensive software. CompuAdd's Integrator software, for example, is a wonderful collection of handy utilities. But no one strikes the balance better than Compaq. Even if another company were to duplicate Compaq's actions, I doubt it could share the success. There's room for only one leader.

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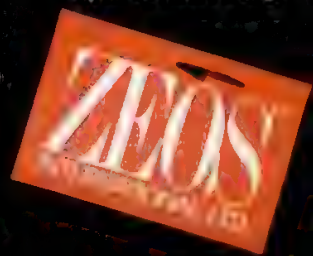
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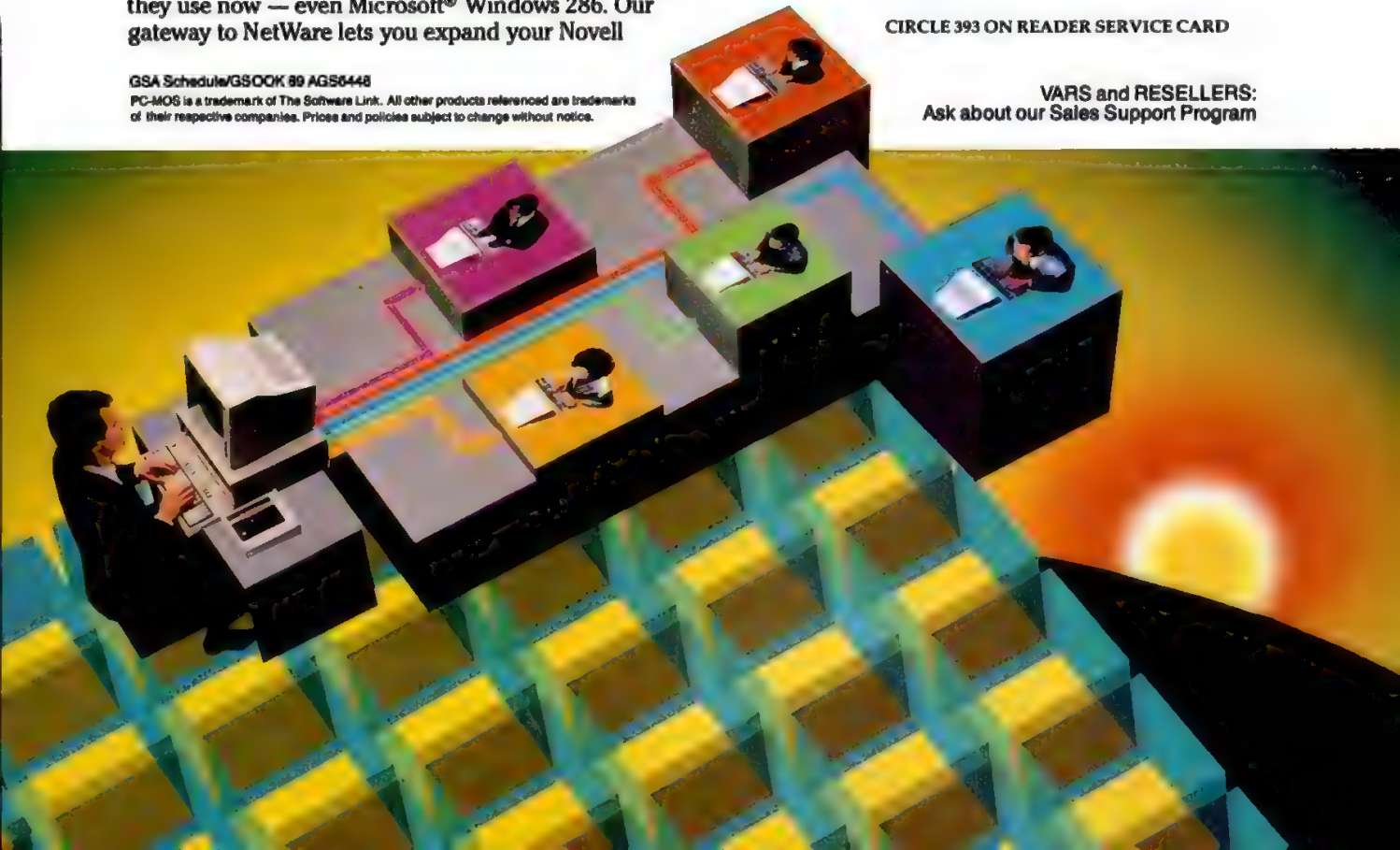
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<eat>

John C. Dvorak



<cat>

Item 1: A small company called ETAK in Menlo Park, California, makes a specialized computer that sits in the trunk of your car and uses local area map information provided on CD-ROM to show you exactly what wrong alley you turned into. You can use the device to program where you want to go; it guides you there effortlessly. It's amazing.

Item 2: A strange product called *Michelangelo* is hot at Comdex, if you ask enough people. Pieced together out of a variety of components, this thing is like a giant plotter, slowly spraying paint on a large wall to reproduce full-color art or photographic images in precise detail.

Item 3: In a recent column, Stephen Manes extolled the virtues of an elaborate sign-making system called the CAMM-1, a fancy computer-controlled stencil cutter that makes the templates for huge signs.

Item 4: Panasonic introduces VCRs that incorporate a bar-code reader and advanced microcomputer logic to help hapless addicts program their machines.

Item 5: At a recent grocers' convention, a company shows a computer-controlled device that scans a photograph and paints the top of a cake with food dye to reproduce the photo.

Item 6: Except for evolutionary changes in chip technology and feature-laden updates of existing software, virtually no innovation has taken place in the desktop computer arena for the past two years.

I'm concerned about Item 6. Over a year ago, a developer friend of mine said that all his buddies—"all the guys with any talent"—are bailing out of the computer scene and going into consumer-product design.

Already we've seen talking Coke machines, the cellular-phone mania, computerized cash registers, Christmas cards that play music, outrageous VCRs, and programmable ovens. People who should be buying computers have been led instead to "smart" typewriters from Brother, Magnavox, Smith-Corona, and Panasonic. People who should be programming computers are designing digital torque wrenches.

Meanwhile, even as all the smart guys are vacating the premises, a new crop of Johnny-come-latelies is pouring into the computer

business because they've been told that's where the action is. I've never run into so many people suddenly interested in computers. What put the bug in their ear?

A NEW MEDIUM

Today's computer has turned into something like a television; it has become a conduit for programming. An enormous effort must be expended to keep people using TV. Twenty-four hours a day, broadcasters must broadcast newer and newer programs to keep people watching. People don't need quite as much impetus to use computers, but they do need some impetus to stick with the computer they use. If no new software ever came out, what do you think would happen?

What would happen if, suddenly, the software scene should stagnate, with nothing new coming on the market except *Microsoft Word*, Version 17.5; *WordPerfect*, Version 28; *dBASE XIX*; and *Crosstalk Mk.60*? What would happen if some other platform came along offering new and better stuff?

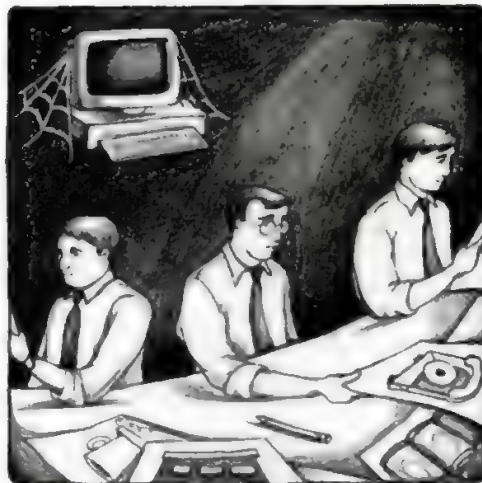


ILLUSTRATION: LISA AMOROSO

I think that today's developers are being driven away from computers by the glitches of the 386-VGA scene, with its different BIOS chips, its video-register incompatibilities, and its plethora of irritating who-needs-this gotchas.

There is a big, clean, unused welcome mat out, waiting for a new standard to come along. That standard is in the wings.

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Inside Track

Bad Moon Rising Dept.: Will Microsoft develop a specification that will render obsolete the multitude of so-called DOS extenders? You know, those are the toolkits and environments that "fix" DOS to run in memory beyond 640K, or to use both low memory and high memory, or to fake LIM 4.0 expanded memory or whatever. **Microsoft** wants to redefine this technology because current DOS extenders don't support protected-mode multitasking the way Microsoft wants it done under *Windows*. Get ready for a slew of **panicky upgrades** of everything under the sun when this happens.

Since few people have moved beyond DOS 3.3, we can expect the configurations of the "personal" machines around the office to be **more and more incompatible** with more and more software. Personally, I've about given up on running games on my 386, which uses a fast Video Seven VRAM VGA. Half of them don't work. But I digress. With a new official DOS-extender standard commingling with a ton of old DOS-extender technology, **expect the worst** in the year ahead.

Magazine Watch Dept.: First we had special-interest magazines, then machine-specific magazines (you're reading the best of the bunch). Now we're starting to see house organs appearing, specific-specific magazines. Most of these are modeled after *Lotus Magazine*, a **cute money-maker** that had the field all to itself. But, like many things in this industry, after a few years of monopoly on an idea, we get a flood of copycats eager to cash in.

Enter the **new** specific-specific magazines. Most of these are ego gratifiers put out by companies that feel they never get enough coverage in real magazines. I expect to see dozens and dozens of these things by the end of the year. Some, like *Microsoft Systems Journal*, are serious attempts at support; they contain no paid advertising and do not try to look like real magazines. That I can live with.

But **so-called magazines** such as *Sierra News Magazine*, a slick house organ for Sierra On-Line, are ludicrous. This publication is owned by Ken Williams. He's also the publisher of the magazine and the executive editor. The last issue I received had a **picture of Ken's wife**, Roberta Williams, on the cover, and she was featured in the first article in the magazine. On page 5 there was another picture of Roberta, and on page 22 there was an article about an article written about Roberta for another magazine. Hey Ken, try flowers!

Then there's *MicroLife*, a super-slick magazine published by **Toshiba** and featuring articles about Toshiba and

ads from Toshiba. After the first few hundred mentions of Toshiba, we get the idea and could do without the ads. The

worst things about this magazine are the pandering "letters to the editor" from subscribers **falling all over themselves** about how great this magazine is and how great Toshiba is. In the issue I have, there is a story called "Technology Hits the Trail" about laptops and wagon trains. Sheesh!

More in line with the Lotus model comes the new magazine from **Aldus**. It's called *Aldus Magazine* and, at \$18 a year, it's

about (guess what?) Aldus products! It features lots of articles that say good things about *PageMaker*. On the inside back cover we see an opinion article by Paul Brainerd (prexy of Aldus). Paul used to work for a newspaper years ago, and I'm told he used to be a pretty good writer. With this piece, he proves that **once you make \$100 million** you sound like a bureaucrat no matter what your background is.

Some of these magazines make you wonder. How long will our forests last at this rate?

I'm told that a company is lucky to get 20 percent of its customers to send in the registration card. These magazines represent a **small incentive** to do that. If

you buy a product, you may as well get these publications too. Most are free. So make sure to send in those **pesky cards**. If enough people do it, maybe they won't be able to afford to print all these magazines and we'll all be better off.

Waaaa! Waaaa! Peddling Dept.: I've heard of software licensed to one CPU before, but this software is licensed to **one baby!** It's called *Your Baby's Nutrition: From Infant to Toddler*. It's from Gerber, the baby food people, and it's available directly from the company for \$15, including shipping and handling. Write to Gerber, General Offices, Fremont, MI 49412; Attn.: Steve Poole; or call 800-4-GERBER. It's the perfect gift for that **yuppie couple** who dote on their hapless child, then leave it with the nanny for a month. The package includes a small notebook, a disk with nicely written software, and a parents' guide to baby nutrition.

I've played with this package and thought it would be a **great marketing gimmick**, since it's designed to make you feel comfortable with the Gerber name and, hopefully, to convince you to stuff your kid with Gerber baby food. Since it's not copy-protected, one would think that Gerber would toss this program into the public domain and let it get copied like mad. **I was therefore shocked** to find strong language enforcing the copyright, to the extent that the company wants you to buy multiple copies for multiple babies. **Give me a break.** Another missed gimmick-marketing opportunity, as far as I'm concerned. Hey guys, wake up!

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I've heard of
software licensed
to one CPU before,
but this software
is licensed to
one baby!



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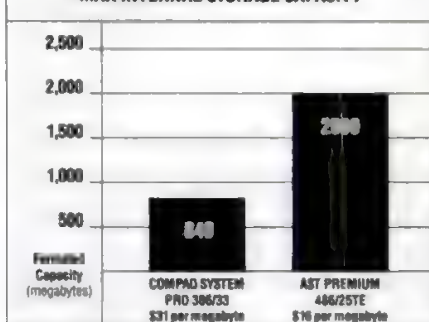
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Fact Jim Seymour



(CSH)
Is Japan Invincible?
Not necessarily.
Japan Inc. has been
very successful in
neglected markets
like laptops,
but U.S. companies
won't give up
the desktop market
without a fight.

(CHT)
Few ideas have so taken hold in the minds of Americans in this century as the notion that the Japanese possess a kind of omniscience in high-technology business. And that, sadly, has led to the modern-day Manifest Destiny theory: that Japan Inc. is not only the U.S.A.'s fiercest and most powerful competitor, but that it will also inevitably win that contest, eclipsing if not vanquishing the big American technology companies.

The problem with this kind of reasoning is that if Fact A is not valid, Conclusion B won't be, either. And any notion of Japanese omniscience in the PC business, at least, is far from correct.

Japan is one of the most insular societies in the world, with little assimilation of outside ideas. The few Western influences that stand out—baseball, blue jeans, American popular music—merely underscore this fact, precisely because they stand out so boldly.

This does not mean that Japan does not study those cultures' conventions for use in trade. While early Japanese auto exports to the U.S. were largely dumpy domestic models—anyone who remembers those first Datsun 410s in the '60s knows what I mean—Japanese auto makers listened and learned. Now they ride the crest of a wave of exported Camrys, Miatas, Lexuses, and Infinitis.

Japanese business itself does not work much like U.S. business. On both the human and the technological levels, from the dreary life of the "salary man" to the limited use of word processing systems, Japanese companies do not foster new thinking, quick responses, or intuitive leaps. And this is clearly a burden for companies in the PC business, where those qualities are some of the most critical assets in a corporate culture.

Granted, some aspects of Japanese business may be part of our future. Wander through offices and R&D centers at Toshiba, for example, and you'll see thousands of the company's portable PCs on workers' desks, with hardly a single desktop PC. Toshiba even uses T5200s as file servers.

Why? Well, obviously because they can supply them cheaply, and (like Apple) because they like to see their own products on their

workers' desktops. But also because Japanese office workers often sit elbow to elbow at long rows of counter tops that serve as miniature desks. The compactness of a laptop is essential in that kind of crowded working environment.

When a visiting American points out that, given the much larger work spaces and desk sizes in U.S. offices, using laptops as primary workstations may not catch on here, there is a nod, a smile, and a quiet "Ahhh, not yet...."

A DIFFERENT GAME

(9/547) (64) (142)
Selling into a market that views and uses the tools you design and build very differently from the way you use them is tough. So Japanese vendors found a new market, portable PCs, where their machines could shape our expectations and thus let them write the rules. And they made it their own. It's hard to think of many serious U.S.-designed laptops. We left an opening, and the Japanese technology companies grabbed it.

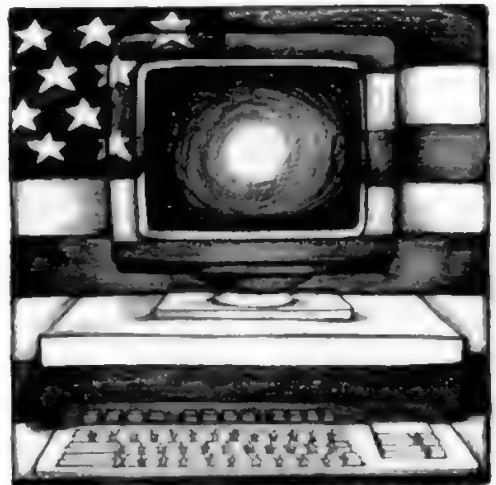


ILLUSTRATION: LISA AMOROSO

That's not likely to change. Even with American names on some Japanese-produced PCs, the laptop market is likely to be dominated by Asian, and especially Japanese, units for years to come. But desktop machines are another matter altogether. U.S. trade regulations have helped to limit Japanese entry into this market. Epson and NEC have achieved a modest amount of success here, but the bulk of the business has remained in the hands of U.S.

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(olympo)
Jim Seymour

and non-Japanese Asian vendors.

Japanese companies are starting to make a serious play for the desktop market. Toshiba, for example, is producing a very nice desktop 386, the T8500/25. It will no doubt sell in modest numbers, piggybacked onto Toshiba's laptop distribution, just as Toshiba earlier piggybacked those portables onto their established printer distribution network.

But I'm as skeptical of large-scale Japanese success in desktop PCs here as I am of U.S. PC companies' success in the Japanese market. Those cultural differences I mentioned earlier are huge stumbling blocks.

Even when Japanese companies hire American management for their U.S. subsidiaries, those managers find themselves pushing a long string back to To-

**Japanese companies
do not foster new
thinking, quick responses,
or intuitive leaps.**

kyo. They often say that the Japanese executives to whom they report don't trust their assessment of where the U.S. market is going, or else they respond so slowly as to give away a critical marketing edge.

We'll see more Japanese penetration of the desktop market as vendors move in with new models, often using technology licensed from American companies like Sun Microsystems. But unlike the markets for monitors, printers, and laptops, where the Japanese roared while America slept, the incredible rate of change in the desktop PC market is likely to defeat Japanese efforts at dominance.

The Japanese believe they're the world's superior race, able to win any contest they enter. While not loud-mouthed and rude about that belief, they aren't embarrassed by it, either. But in the shrinking and increasingly open world of the 1990s, that attitude is going to get roughed up pretty badly. The U.S. desktop PC market may well be one of the most prominent forums for that comeuppance.

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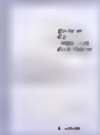
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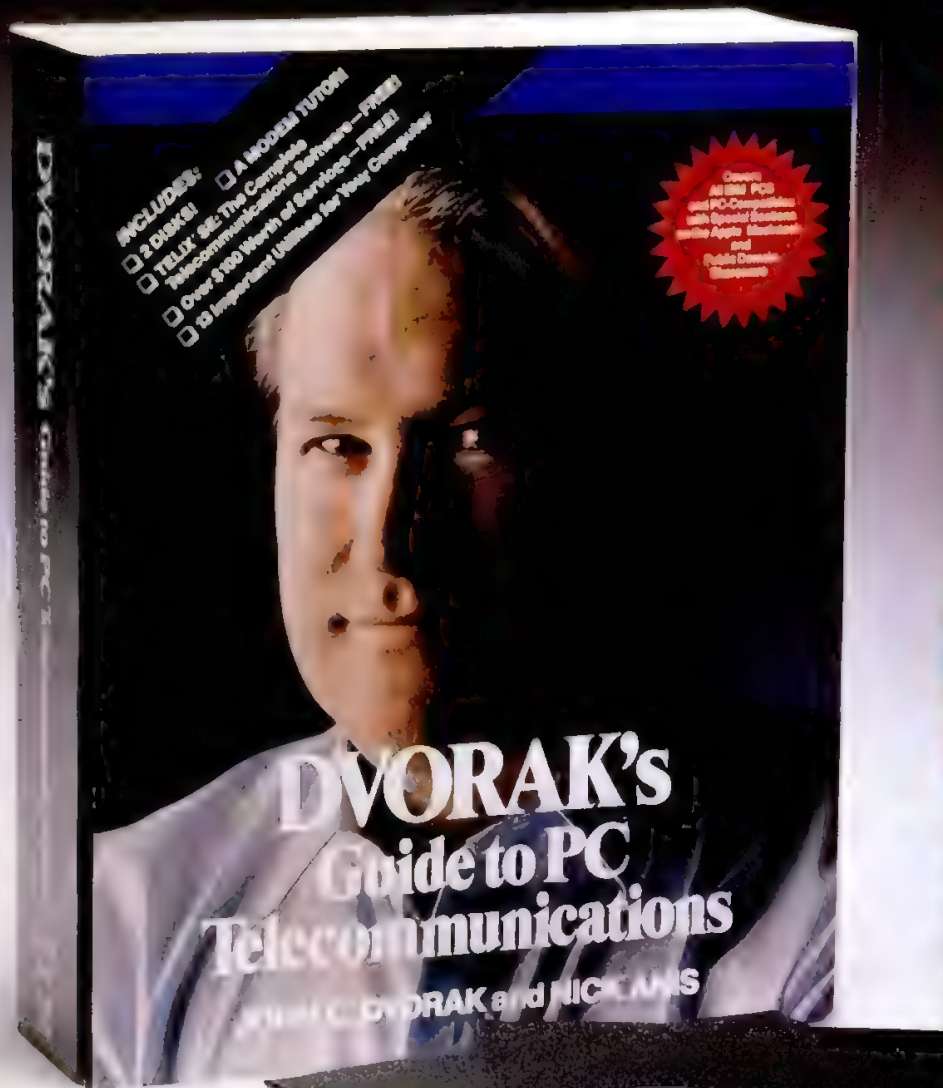
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by John C. Dvorak and Nick Anis • Foreword by Peter Norton

William F. Zachmann



**Want to know
what the hot
software will
look like in the
year 2000?
Take a look
at today's
computer games.**

Those who peer into the future of software are well advised to play computer games. That's right, games. Not only are they fun, they'll give you important clues as to what we will be doing with computers.

I'm talking about games like Sierra On-Line's *Leisure Suit Larry III: Passionate Patti in Search of the Pulsating Pectorals*, Accolade's *The Cycles*, Microsoft's *Flight Simulator 4.0*, Maxis' *SimCity*, Spectrum Holobyte's *Tank*, and Springboard's *Hidden Agenda*. I'm talking about the large and rapidly growing selection of games for IBM-compatible PCs.

"Games?! We haven't got time for games! We're concerned with using computers for business productivity. The last thing we want is our employees playing games on personal computers! Games aren't on our approved software list! If we catch anyone playing games around here, it goes on their personnel records. Repeat offenses can lead to dismissal."

This might be the typical reaction from someone who manages personal computer use in a business enterprise. Games aren't considered relevant to the business of business. They are viewed as unproductive nuisances at best; something to be vigorously discouraged in the work force.

I'm not arguing that employees should be encouraged to play games on company time. Games, unlike spreadsheets or word processors, don't do anything to improve productivity. Quite the contrary! Nevertheless, I'll say it again: Computer games, more than anything else, reveal the future of software and are the key to understanding how we are going to use computers by the end of the 1990s.

Let me explain why. The spectacular explosion of personal computer use brought with it an entirely new use for computers. In this model, the computer becomes a direct extension of the individual worker, similar in function to a bulldozer or sewing machine. It gives the individual powers that he or she didn't have before.

The personal computer is a versatile tool that augments the individual's ability to create documents, analyze numbers, design buildings, and even make music. Like every other tool in human history, it has extended human capabilities by granting the individual an enhanced ability to *do*. By contrast, the para-

digm of computer use that is now emerging will be characterized more by what the computer *does* to the individual than by what it enables the individual to do. Or, put another way, it will be characterized by what it empowers the individual to *be*.

Let me explain what I mean by that. PC software lets us do—better, more efficiently, more accurately—the things we already know how to do. But what we learn in using it is incidental at best. Mostly, we just learn how to use the software. We don't really learn anything new.

MAKING KNOWLEDGE FUN

But new-paradigm software, of which today's computer games represent early prototypes, will actually teach us new things. It will show us how to do things we cannot now do, instruct us in possibilities of which we aren't even aware, enable us to explore territory unknown to us, and assist us in developing capacities we didn't even know we had. Moreover, it will do

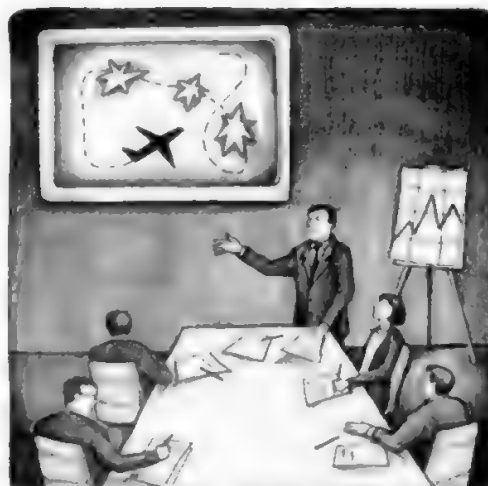


ILLUSTRATION LISA AMOROSO

this in ways that we find enjoyable, by creating simulated experiences that teach us useful things about the real world. It will, as George Gurdjieff used to say, "combine the pleasurable and the profitable."

Back in the late 1960s, I worked on a programming project to develop a business simulation game for the Harvard Business School. It was written in FORTRAN and ran, as I recall, on the Dartmouth Time Sharing System (DTSS).

William F. Zachmann

In the game teams, students were given a certain amount of financial resources that could be invested in various combinations of manufacturing and warehouse facilities in locations throughout the United States. The teams had to make decisions on pricing policies, advertising

expenditures, and so forth in each of the various markets. Each team's sales, market share, and profitability during each play period depended upon what the other teams did and on the economic "laws" built into the game's calculations. There was even a linear programming module that calculated the least cost routings for delivery of goods.

This particular game probably wasn't much fun to play. The competitive pres-

sures at the school and the klunky KSR33 Teletype terminals that were used for input and output didn't add up to a very entertaining game-playing environment. But the game itself was part of a serious learning process.

Today's computer games are much more fun, but otherwise they have much in common with this early game. Like it, they create a simulated environment in which the player can learn by experience. Admittedly, learning your way around Noontonyt Island as Larry Laffer or Passionate Patti isn't quite the same as learning the consequences of concentrating too much on one market area at the expense of others. On the other hand, flying an airplane in *Flight Simulator* or managing a city in *SimCity* or running the Central American country of Chimerica in *Hidden Agenda* does have a lot in common with the real thing.

A BRAVE NEW WORLD

Today's games are mostly just games, and only incidentally create opportunities to learn something useful. And the simulated experiences they create, while an enormous improvement over the business simulation game for the Harvard Business School, are still a far cry from being realistic. But two important developments we can expect to see over the next several years will change that.

First, the maturation of hardware technologies will let game designers create far more realistic simulations of experience than is possible today. And second, the inclusion of objective material in entertainment software will evolve from treating it as incidental elements to making it a central focus in its design.

In the process, the computer industry will broaden substantially as it moves into areas now thought of as completely separate: entertainment and education. The result? The computer industry will be able to start reaching for the billions of dollars currently spent on entertainment. And the very nature of human education will be profoundly affected as advanced software makes learning new things more enjoyable.

Combining the motivational value of the movies and television with the learning possibilities of realistically simulated experience via computers will be a potent elixir for our industry in the decade ahead. It is the intellectual equivalent of atomic fission. Some of the great fortunes of the '90s will be made there. ■

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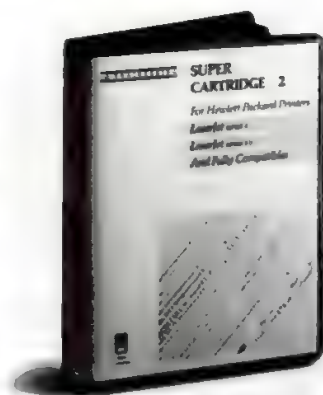
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Stephen Manes



**The best source
of information
about computers
isn't in any
database. It's in
the collective
minds of user
group members.**

Of course I knew better. Rule 2 of The Computer Survival Handbook clearly warns never to try *anything* new with hardware or software when the relevant technical support office is closed. But I was under the influence of Catch 2 of the same handbook, which points out that the only time you ever need or want to try something new is on evenings and weekends—when the relevant technical support office is closed.

So instead of enlisting the support of the manual in my desperate hunt for an arcane word-processing trick buried 18 levels deep in the context-insensitive help system, I placed a long-distance emergency call to my friend Fontmeister. In about 15 seconds I had the answer.

The only drawback was that while applying Fontmeister's trick to my recalcitrant document, I had to listen to his interminable tale of woe. A brand-new power supply of typically indeterminate origin had somehow fried the innards of his Disintegrator, the killer 386 machine he had personally assembled from parts, no two of which had heretofore been seen on the same continent. It was somewhere during this recitation that I realized we constituted a *de facto* user group.

User groups have a fond place in my heart. Seven years ago in New York, I joined one for three main reasons: I wanted to make my printer respond to *WordStar*'s special-effect commands, I needed to figure out how to use random files in BASIC, and I'd recently gotten divorced.

The user group didn't help much with Reason 3; at the time, the membership was almost exclusively male. But among the two dozen participants at the first meeting I attended was one fellow who knew everything there was to know about boldfacing and superscripting in *WordStar*, and another who set me straight about BASIC's peccadilloes. I was hooked—in a town where computer dealers rarely bother to return phone calls, where else could you find such a bottomless fount of wisdom to depend on?

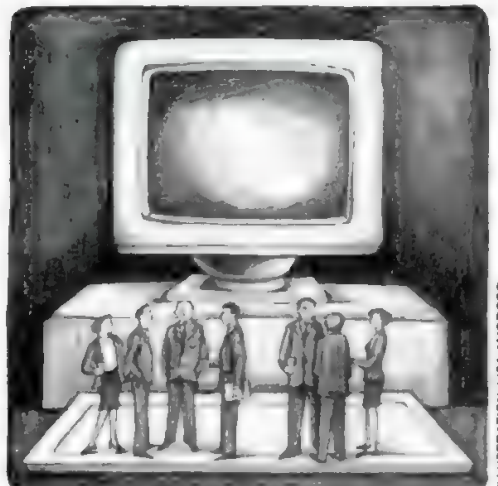
The user group was where I bought my first RAM and I/O card and my first keyboard macro software. Its newsletter published the

first article I ever wrote about computers—an arcane but essential batch file trick that a board manufacturer's tech support department hadn't managed to figure out. The group introduced me to everyone from ego-crazed consultants to industry stars to other beginners—many of whom have since gone on to fame and fortune in the computer trade.

THE JOY OF HELPING

In the intervening years, individual user groups have experienced the ups and downs, political upheavals, and not-so-subtle purges common in volunteer organizations, where power is among the few rewards beyond the joy of helping others. But though the user group movement overall has continued to grow, its leaders often complain that they're increasingly taken for granted.

It's not hard to see why. In the distant past, this magazine and others published a monthly listing of all the local user groups. When this



eventually became unwieldy, the magazines simply dropped it—even as the groups were growing bigger and more sophisticated.

And today's industry seems to have a schizoid relationship with user groups. Vendors still court the groups, whose members can be so powerful in spreading the word about new products. But the same vendors have been known to gripe about the groups, either as supposed hotbeds of quantity-one nerds who

Stephen Manes

don't influence corporate buying, as dens of misers on the lookout for freebies and discounts, or (more accurately) as cells of freethinkers who actually have the gall to publicly air the vendors' dirtiest laundry and to complain vociferously about the their sleaziest policies.

So it's little wonder the user group movement sometimes feels left out and unloved. But it's also clear that user groups still wield enormous power as the conscience of the industry. The opinions expressed in user-group circles tend to be arrogant, imperious, opinionated and, more often than not, accurate. You'll rarely hear members hedging, either in person or in print, about what they think.

User-group pressure was a major factor in the virtual abandonment of copy-protection among software vendors. User-group libraries made shareware possible. And user-group meetings and newsletters continue to serve up early-warning radar alerts about the flea-bitten dogs of the computer business, from bug-ridden pro-

grams to incompetent dealers.

The educational role of user groups today can hardly be overestimated. Graphical user interfaces can't hide the fact that computers are becoming more complex, not easier to use but harder. Of all the resources in the computer business, there remains one more useful than any micro-processor, language, or other ware hard or soft. I refer, of course, to that rarest of beasts: The One Who Knows.

Friend or acquaintance, colleague or sales rep, The One Who Knows is often the only defense against the dark clouds of fear, uncertainty, and doubt. Big companies can and do pay handsome sums to such experts, but smaller fry (including governments) often can't or won't. The user group makes Ones Who Know available by the dozens—for free.

How many times does a computer suddenly appear on the desk of a computer virgin, with no help whatsoever beyond what the manual provides? How many times does the documentation run out when you attempt to use some "advanced" feature of your software? Somebody "out there" undoubtedly knows the answer, and usually a single visit to a user

group will find that somebody.

These triumphs of voluntarism and unpaid consultancy have probably defused more frustration than any other single source. User group members go so far as to publish their phone numbers in the newsletters, encouraging others to call in when baffled, confounded, or stuck. This sort of altruism extends throughout the workings of a group—from the laborious task of putting out a monthly newsletter to the delicate diplomacy of cajoling an industry star into showing up after a local expert has justly trashed his latest product.

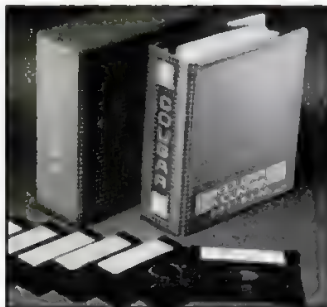
A few members, particularly free-lance consultants, do gain a payoff simply from visibility; the group becomes an arena in which to flaunt their considerable skills. For most, though, the work is its own reward; it's a nice feeling to be a locally recognized expert, even if on something like the late unlamented Otrona Attache.

One of which, years ago, had been cannibalized for a capacitor or something by my friend Fontmeister—who wound up his story with, "See you later. You don't know anything about power supplies, and I just remembered this guy in my user group . . ."

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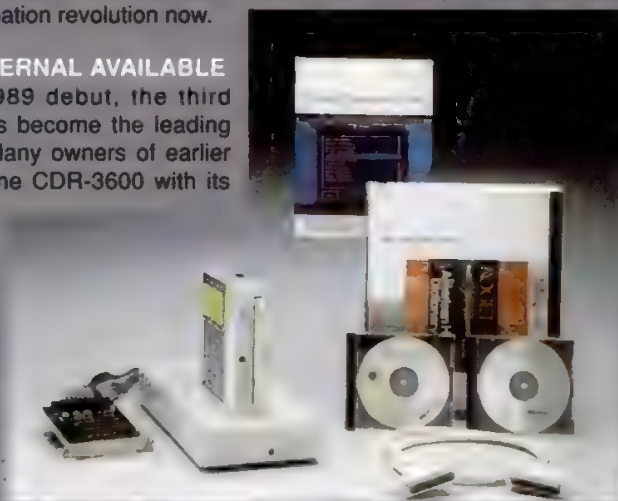
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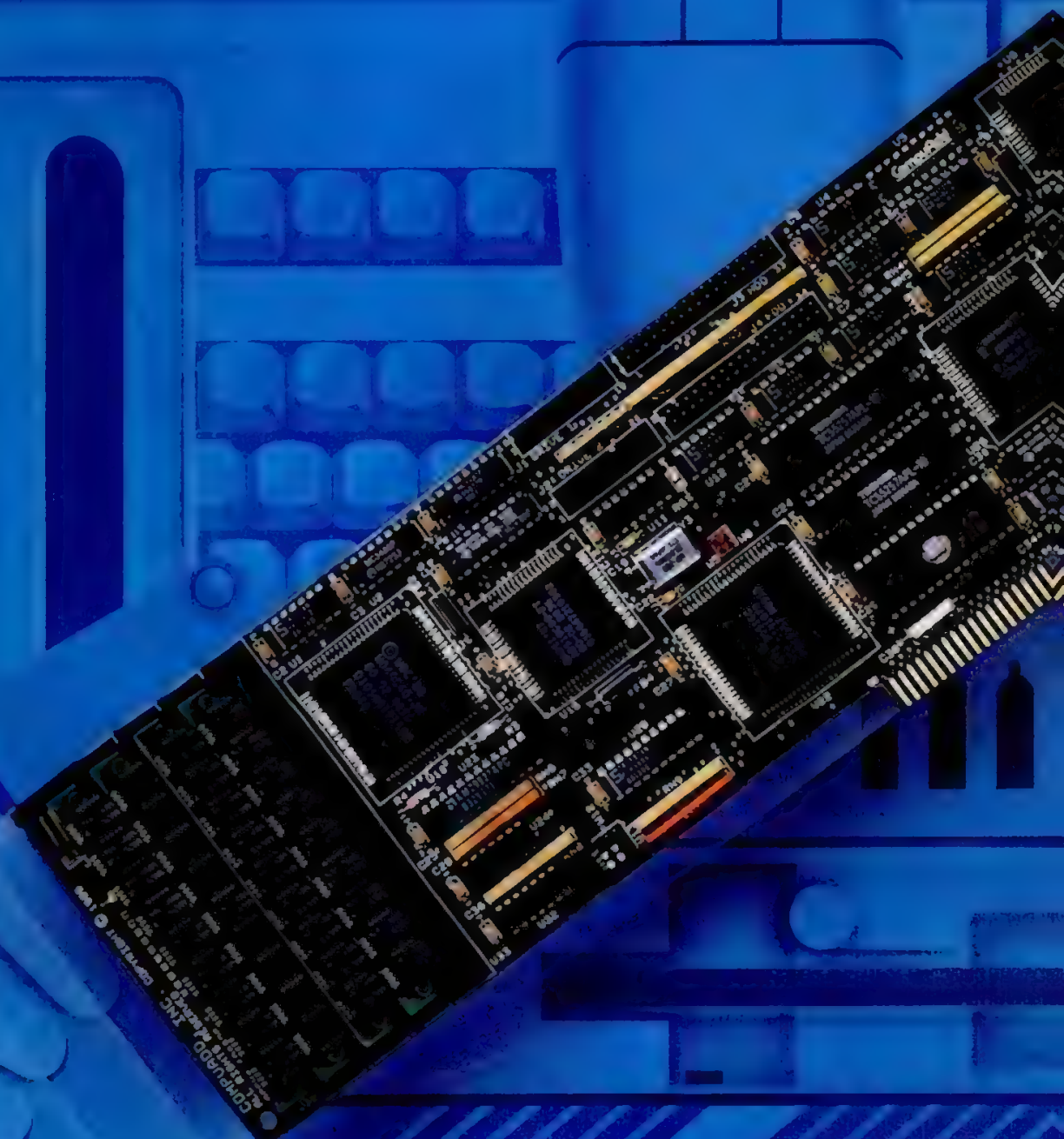
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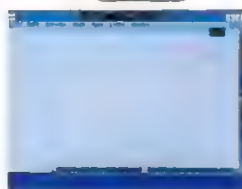
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Without HardCache/ESDI

At 0:00:12

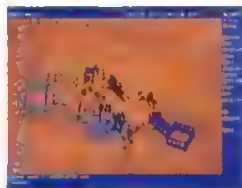


At 0:02:14



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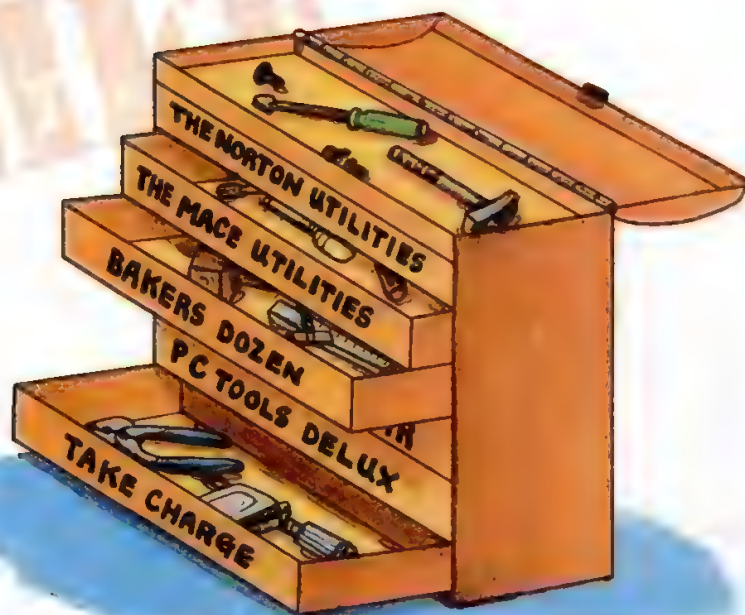
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<eye>



DOS Utilities Save the Day

<st> **You have only to erase
valuable data once to
understand why everyone
needs a good collection
of DOS utilities.
But unerase is just one of
the things these
five packages do well.**

<copy>
by Edward Mendelson

<xt> It's a jungle in there. Most of the damage that's likely to strike at your data doesn't come from external enemies like thieves, vandals, or even power surges sent down the wires from the electric company. The worst and most-common dangers to your disk come from the software in your own computer and the damaging keystrokes you might unintentionally make.

An overactive disk cache program could write a sector of program code into the middle of a directory. A database program could get confused and lose three-fourths of your customer records. A normally well-behaved memory-resident utility might get into a snarling catfight with a new utility that claims the same part of your computer's RAM, and the result is a FAT (or *file allocation table*, the master key to the contents of your disk) transformed into electronic confetti.

Entering a series of keystrokes that a program's authors never anticipated might leave you sitting in front of a stalled computer with a blank screen, and your data lost in RAM or scrambled on your disk. Careless keystrokes in a spreadsheet program could send your worksheet into hyperspace. Mistype a DOS command, and yesterday's version of your work

overwrites today's version instead of the other way around. And because DOS doesn't make you confirm that you want to erase a file, the one file you wanted to keep is the one you inadvertently delete.

These disasters are the reason the packages surveyed in this article—*Baker's Dozen*; *The Mace Utilities*; *The Norton Utilities, Advanced Edition*; *PC Tools Deluxe*; and *Take Charge!*—exist. Dangerous as the disk jungle is, it isn't invariably fatal. Unless a disk is physically damaged, you can usually get back most or all of the data lost by deleting or overwriting.

The undelete programs in today's disk utility packages can automatically recover deleted files or lost data, even when the latter is scattered randomly around the disk. These packages also include sector editors, which let you modify any byte on your disk, whether in a file or in an unused area of the disk, and directory utilities that let you change a file's attributes, date, and even its size. Most self-respecting packages of this type also come with one or more of the three standard large-scale disk utilities: a cache, a defragmenter, and a backup program. (For even better models of these large-scale utilities, see the sidebar "The Specialists: Top Choices Among Single-Purpose Utilities.") As these packages evolved, they typically added other conveniences ranging from programs that beep your speaker to full-fledged menu systems that let you say goodbye to the DOS command line forever.

Today's most advanced disaster recovery programs—the Disk Doctor in *The Norton Utilities, Advanced Edition* and the Emergency Room in *The Mace Utilities*—can resuscitate disks whose very existence DOS refuses to recognize by reconstructing not merely individual files but also the hidden regions of a disk that DOS needs to consult to find the logical disks on the physical disk. (A logical disk is what you access when you type C: at the DOS command line; there can be more than one logical disk on a physical disk.)

The hidden regions are the *master boot record* and the *partition table*, which tell DOS which part of the physical disk it's allowed to use and how its own turf is divided, and the *DOS boot sectors* of each logical disk, which tell DOS how to read the FAT and directory of the drive. To complicate matters, with DOS 3.31 and above, each logical disk has its own separate *partition table*, which tells DOS where to find the *next* logical disk.

SOFTWARE DOS UTILITIES



NOT JUST CHILD'S PLAY

Compared with the task of restoring these delicate bytes, the job of recovering a deleted file seems like child's play. When DOS deletes a file, it leaves all the data on the disk. It simply replaces the first character from the file's directory entry with an arbitrary character that signifies a deleted file, and then blanks out the entries in the FAT that tell DOS where to look for everything in the file that follows

<djmp>

the first cluster. (A cluster is the smallest unit into which DOS divides a disk.)

To recover a deleted file, a utility asks you for the first letter of the filename. The directory entry tells the utility where to find the first cluster of the file and the size of the file. With this information the utility can go to the FAT and fill in the entries needed to let DOS find the full extent of the file. (See the diagram "Gone but Not Forgotten: How Undeleting Works.")

However, it isn't always that easy. If the deleted file was fragmented, with its clusters scattered around the disk, the undelete program will have to ask you to track down the scattered clusters by



GONE BUT NOT FORGOTTEN: HOW UNDELETING WORKS

ERASED FILE

When DOS deletes a file, it doesn't remove the data from the disk. The clusters that originally contained the data still retain it. But the entries in the FAT that correspond to those clusters are changed to zero, indicating that DOS can use these

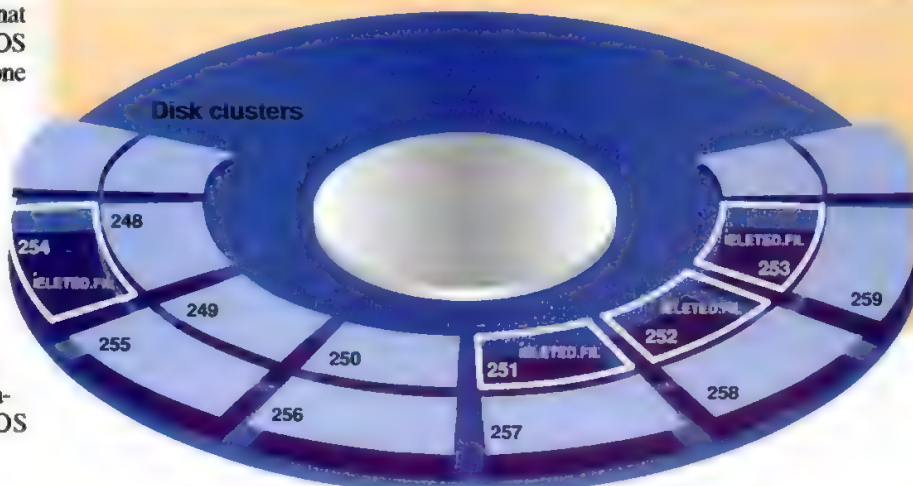
clusters for other files in the future. The directory entry for the file still has the information that was in the directory before the file was deleted, but the first character of the filename is replaced with the lowercase sigma, ASCII 229.

Directory listing

Filename	Extension	Size	Date	Time	First cluster
LETTER	AAA	4089	3-27-90	4:51p	135
LETED	FIL	7	3-27-90	10:07a	251
LETTER	BBB	6052	3-27-90	3:00p	346

File allocation table

248	249	250	251	252	253	254	255	256	257	258	259



SOFTWARE DOS UTILITIES

searching for words that you remember are in there. If you deleted the file a few days ago, data from another file may have been written over part of the lost data. And if you are trying to recover an older version of a file that exists in a newer form, the directory entry won't be of help. The utility has to create a new directory entry from scratch and will rely on you to identify the clusters that contain your lost data.

Programs included in *The Mace Utilities*, *The Norton Utilities*, and *PC Tools Deluxe* that enable recovery from an accidental format also make it possible to recover a fragmented file automatically. These programs save a copy of the FAT

and root directory to a file on-disk and, even if you've accidentally formatted the disk, can locate that file and use it to reconstitute the whole directory structure with all its files. Thanks to the safety precautions built into DOS Versions 3.0 and later, it's hard to format a disk accidentally, but these format-recovery programs are still valuable because the undelete programs in the same packages use the stored copies of the FAT as a resource for locating every last fragment of a deleted file.

Starting with Version 3.0, DOS has improved your chances of recovering lost

data by trying not to overwrite the area occupied by a deleted file until it absolutely has to. If you're still using DOS 2.0 or 2.1, you owe it to your data to upgrade. But be sure to back up your files—twice—before you make the switch.



PRODUCT FEATURES

All the products in this review undelete files and let you edit any byte on a disk; each also contains a variety of other disk- and file-maintenance utilities. Unless noted, all these packages can work with the large partitions created by DOS 3.31 and 4.x. Missing from this roundup is *DOS-utls*, which OnTrack Systems withdrew because a new version was scheduled for release too late for evaluation.

While these packages will work with networks, some of the most important disk functions cannot—and should not—be used while a machine is tied to the LAN. You don't want to edit a sector while someone else is trying to access the file that contains that sector.

Disk utilities for OS/2 don't exist as yet, but some of these vendors have promised them for the future. OS/2 disk utilities will have to work very differently from their DOS counterparts, because OS/2 normally prevents programs from writing directly to the disk. As in a network, OS/2 doesn't want one program to modify a sector that another program is about to use.

In testing the advanced recovery programs in the *Mace* and *Norton* packages, I did things to a hard disk that you wouldn't wish on your worst enemy. I wiped out partition tables and DOS boot sectors, and scrambled FATs in half a dozen ways. (Warning: Professional Driver on Closed Course. Do Not Attempt These Maneuvers on Public Highways.) Both *Mace* and *Norton* did a credible, often impressive job of recovery, but I encountered bugs and problems that both vendors rushed to fix.

The versions you buy now will be better than the ones I tested, but no file-recovery program can ever be perfect.

Files are subject to too many kinds of destruction to let any program completely guarantee recovery from disaster. The only way to truly guarantee the safety of your data is to make constant backups.

Someday, you're probably going to want to hear the wail of the siren as one of these utilities hauls out the stretcher and

UNERASED FILE

An undelete program first asks you which letter to use to replace the missing first letter of the file. It then reads the first cluster from the directory entry, takes note of the size of the original file (also indicated in the directory entry) and moves on to the FAT.

The program calculates from the size of the file the number of clusters that have to be recovered—in this case, four clusters of 2K each for 7K of lost data. Starting with the FAT entry that corresponds to the first cluster indicated in the directory entry, the program checks whether the FAT indicates that the next cluster is unused.

If the FAT entry for the next cluster contains a zero, then that cluster is unused, and the undelete program assumes that this second cluster was originally part of the file. The program then puts the number of the second cluster into the FAT

entry of the first cluster in order to tell DOS to look to the second cluster to get the data that follows the first cluster.

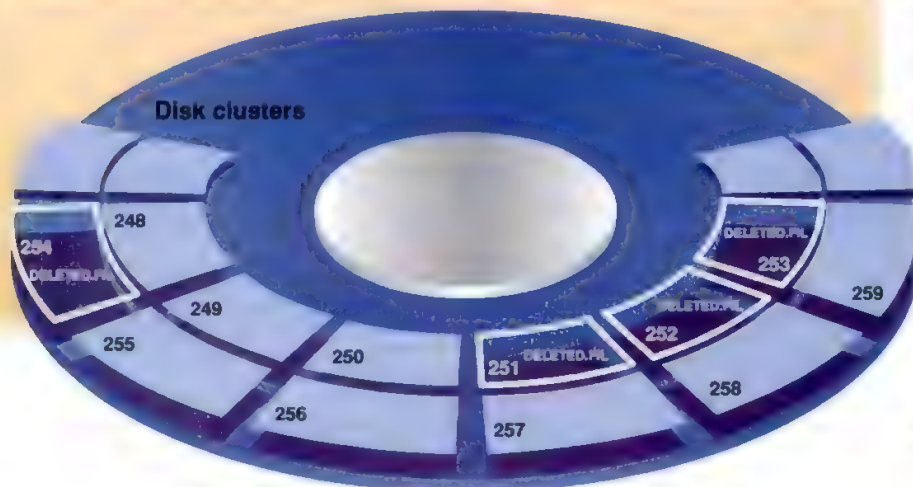
The undelete program continues until it has reclaimed enough clusters to recover the original file size. In the FAT entry for the last cluster of the file, it inserts the number 65,535 (hex FFFF) to indicate that this cluster is the end of the file. By "waking up" the FAT entries, the data is now available to DOS, and the file has been recovered.

If the original file was fragmented, the undelete program will try to skip over any files that broke up the original cluster chain, or, if you use a program that stores images of the FAT, the program will consult this stored image in the hope that you stored it before deleting your file. The full list of clusters in the chain can then be found in the image file and used to restore the file.

Directory listing

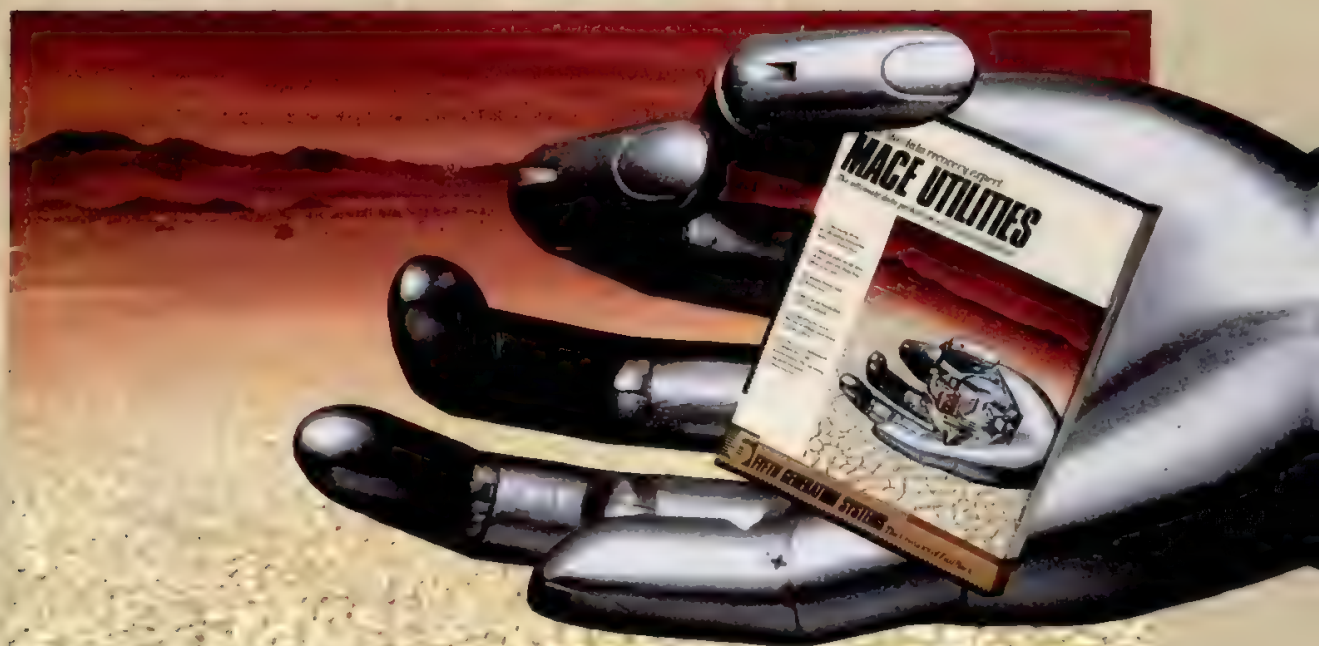
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DELETED	FIL	7	3-27-90	10:07a	251
LETTER	BBB	6052	3-27-90	3:00p	346

File allocation table



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oxygen and goes to work recovering your files. Don't make the mistake of waiting until the emergency team arrives. Go out and get one—or more—of these programs now.



Baker's Dozen

The spreadsheet-style calculator in ButtonWare's \$59.95 *Baker's Dozen* lacks a function to tell you how many utilities you actually get in a baker's dozen, but you can probably guess the answer is 13. By far the most powerful of these is a disk utility that manipulates, edits, and undeletes files. But the other 12 have some impressive skills of their own.

The whole *Baker's Dozen* package is a quirkily mixed bag of general-interest utilities and specialized programmer's tools. Sometimes these two aspects are mixed within the same module. The calendar, for example, comes with an almost folksy mini-almanac that reminds you of Sadie Hawkins Day and Mardi Gras, tells you which animal the current Chinese year is named after, and is more suitable for entertainment than as a serious appointment book. But if you want to modify the hotkey that pops up the calendar in its memory-resident mode, you'll have to identify the key through the hex digits of its scan code. A more specialized utility included in the package tells you those digits.

The *Baker's Dozen* disk utility offers a comparable mix of clarity and obscurity. It can give you a simple directory listing of

files with their dates, sizes, and attributes, but it also lets you get your hands dirty modifying the FAT when manually rebuilding a file. The FAT editing screen is even more functional than the ones in *The Norton Utilities* and *The Mace Utilities*. With *Baker's Dozen*, you can trace the FAT chains forward or backward and each FAT entry that merely points forward to the adjacent entry is indicated by an arrow. Rival programs always display the number of the target entry, so you have to stop and think whether the number is adjacent or remote, and that can lead to confusion between the number to which the entry points and the number of the entry itself.

When you recover a deleted file, the disk utility makes you confirm that you're getting what you want, and expects you to know something about DOS in return. You select the file you want to recover by browsing through a raw display of directory entries, complete with hex characters that will be incomprehensible to the uninitiated. Once you select a file, the program displays available clusters one by one and asks you to accept them as part of the file. The program only takes you forward through the disk; it doesn't let you search for data or move backward for stray clusters as you can in other programs, but fortunately you won't need to make any of these maneuvers with most files.

A separate program searches for text strings, but the disk utility can search for strings on any cluster, including deleted files. This function has refinements you won't find elsewhere, including one option to report only the first "hit" in each

1997

SOFTWARE DOS UTILITIES

PC FACT FILE

Baker's Dozen

Version: 1.0

ButtonWare, P.O. Box
96058, Bellevue, WA
98009; (800)
J-BUTTON, (206) 454-
0479

List Price: \$59.95

Requires: 256K RAM,
DOS 2.0 to 3.3

In Short: This compact set of utilities ranges from a miniature spreadsheet and tiny port-swapping TSRs through a powerful disk-manipulating utility. The disk utility makes you do a lot of work manually that other programs do automatically, but it has some functions that aren't duplicated elsewhere.

CIRCLE 306 ON READER SERVICE CARD



cluster, and another to report when part of the string is found at the edge of a cluster.

Other functions in the disk utility include changes to file dates and attributes; calculations of the disk space needed to store files; a hex editor that lets you toggle from the familiar DEBUG display with hex data on the left and ASCII on the right to a full-screen ASCII display; and a batch file creator that automatically builds a file to perform a single command on a group of files.

ROUNDING OUT THE BAKER'S DOZEN

The rest of the *Baker's Dozen* programs range from a miniature spreadsheet to small utilities for swapping COM ports and LPT ports. The spreadsheet handles sheets of 6 columns by 20 rows, but it's designed mostly for use as a calculator. It includes business, trigonometric, and other advanced functions, performs date-and-time calculations, and shares with more-advanced spreadsheets a "smart cursor" feature that moves in the direction you prefer whenever you press Enter.

A small TSR prints spreadsheets sideways on dot matrix printers. Another TSR captures and displays text screens, and yet another redirects printer output to a file. Command-line utilities sort ASCII files using up to four fields, compare text files, set DOS screen colors for CGA and EGA displays, and remove a directory with all its files and subdirectories. All the utilities can be accessed from a menu, which can be rewritten to include any applications you choose.

The full *Baker's Dozen* can be downloaded from bulletin boards and CompuServe as shareware, but its more powerful components shouldn't be used without the



When you want to recover a deleted file using the DISKUTIL program in *Baker's Dozen*, you first select the deleted filename from this raw display of directory data.

SOFTWARE DOS UTILITIES

printed manual—which is also worth having for its technical summaries of DOS's FAT and directory structure. Because the program hasn't been updated since 1987, some of its disk-maintenance functions work erratically or not at all under DOS 4.0. But even with earlier DOS versions, this is a program best suited to those who feel comfortable in the deeper recesses of DOS and in using the hex numbers that the program normally displays. For these experts, *Baker's Dozen* offers conveniences that easily justify a stop at the bakery.



The Mace Utilities

Paul Mace's disk utilities sometimes resemble a M*A*S*H unit. Except for a few recently spruced-up menus, they don't look pretty, and the working environment can be cramped and makeshift. But Fifth Generation Systems' \$149 software repairs damage that nothing else has the nerve even to take a look at. *The Mace Utilities*, Version 1990, may feel a bit awkward and inconsistent in everyday use, but you should always try to have a copy of this utility available in case of disaster.

Mace patches up more kinds of disk damage more quickly and thoroughly than any other emergency service you can find. It had no trouble restoring the wiped-out boot sector of a hard disk formatted under IBM's most recent DOS 4.01; *The Norton Utilities* couldn't fix this problem under this DOS version until I reported it and the company revised its Disk Doctor program. When I mangled a drive's FAT by making some of the cluster chains point back at themselves rather than forward to the end of the file, *Norton* seemed to lock up the computer; tech support told me the program was in fact working but could take hours to sort out the problem. *Mace*, confronted with the same situation, sorted out the files in a matter of seconds.

When I copied a sector of irrelevant data from a program file directly into the FAT, neither *Mace* nor *Norton* nor all the king's men could put the files entirely back together again, but *Mace* tended to do a more complete job that needed less manual intervention afterward. *Mace* stores on a different disk a copy of anything it modifies on the mangled disk; that way if the cure turns out to be worse than the disease, you can then restore the drive to its original

The Mace Utilities' sector editor, MUSE, displays ASCII characters immediately above the corresponding hex numbers. You see less data per screen than in other sector editors, but it's easy to keep track of the relationship between ASCII and hex.



confused condition and try manual file recovery.

Mace also shines at solving more-mundane problems. When you need to get back a file deleted by mistake, *Mace* can use all the standard tools and a few extras. You probably won't need *Mace's* format-recovery program to recover from a format, but it stores an image of the FAT that the undeleter can use for flawless, automatic recovery of deleted files.

Mace has two specialized programs for manual recovery: one for restoring text files and one for dBASE files. Each searches for data in the characteristic formats of plain-ASCII text, *WordStar*, *Microsoft Word*, *WordPerfect*, or dBASE, and then displays the found data and asks if you want to add it to the file you're trying to rebuild. When you're through adding clusters, *Mace* lets you mark the exact end of

the file's data on-screen and then cautiously insists on saving the file to a disk different from the one where the data was originally found so that you can immediately go back and try again if the recovery wasn't a success.

MUSE, *The Mace Utilities'* sector editor, has abilities you won't find elsewhere but also dangers and limitations that should make you hesitate before using it. It lets you jump with one keystroke from a file-editing screen to a screen where you edit the file's FAT entry, and then to another screen where you edit the file's directory entry. No other sector editor permits you such athleticism, but neither does any other sector editor use so confusing and unintuitive an interface. You press Alt-letter keys to accomplish everything, and if—as is all too likely—you neglect to press Alt, an extraneous letter can end up in the file, directory, or FAT. The program warns you that changes have been made before it writes to disk, but you may not notice changes made inadvertently. Unlike *Norton's* NU, MUSE lacks search and undo functions and won't let you edit absolute sectors or the partition table.

MORE MACE ARTILLERY

Mace provides further heavy armor in the form of two memory-resident programs: one tests your disk for virus infections; the other periodically saves all of DOS memory to disk so that after a power failure you can return your computer to the state it was in at the moment of the last save. This Power-Out Protection (POP) program can't save expanded or extended memory, so it has limited value for the advanced us-



The Mace Utilities, Version 1990
Fifth Generation Systems, 10049 N. Reiger Rd., Baton Rouge, LA 70809; (800) 873-4384, (504) 291-7221.
List Price: \$149.
Requires: 256K RAM, DOS 2.0 or later.
In Short: *Mace* can automatically cure major disk disasters that defeat other programs, but it sometimes does an incomplete job of curing minor problems. The interface is clumsy, but the programs behind the interface are impressively powerful.



CIRCLE 397 ON READER SERVICE CARD

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microLaser™ from Texas Instruments: the affordable PostScript printer you can call your own.

Finally, for less than \$3,000 you can have a PostScript laser printer right at your desk. TI introduces its new microLaser, with the features you want — now and in the future.

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At only 13.4 inches wide and 14.2 inches deep, microLaser may be the small kid on the block, but it packs plenty of punch. This printer takes full advantage of the advanced software that runs on your PC. That's because it uses the Adobe® PostScript printer language and is compatible with the HP LaserJet® Series II — allowing you to switch between them easily. With that kind of flexibility, the six-page-

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Capabilities that grow as your needs grow.

One of the best things about microLaser is that you only buy what you need. So if you're not ready for PostScript language, you can buy the standard microLaser for less than \$2,000 and add PostScript software and other powerful features later.

You can upgrade microLaser without tools or technicians by simply adding upgrade boards. These boards include up to four 1 Mb increments of memory, serial and AppleTalk® interfaces and a PostScript interpreter. All you have to do to get additional fonts or emulations is plug optional microCartridges into two credit card-size slots.

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Part of what makes microLaser a truly personal, desktop laser printer that takes up so little room is its paper drawer, which slides inside. Because microLaser holds 250 sheets standard (it holds 500 when you add an optional paper drawer), you spend less time refilling paper and more time creating superb-

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Not only that, you get an expert-written "How To" booklet so you can get started quickly and easily.

Call TI at 1-800-527-3500 for details! This offer ends April 30, 1990.



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To find out more about how you can have affordable PostScript printing right at your own desk, call TI today.
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SOFTWARE

DOS UTILITIES



DOS UTILITIES: SUMMARY OF FEATURES

Products listed in ascending price order

	Baker's Dozen	Take Charge!	PC Tools Deluxe	The Mace Utilities	The Norton Utilities, Advanced Edition
List price	\$59.95	\$99.95	\$129.00	\$149.00	\$150.00
FILE AND EDITING FEATURES					
Text editor	☐	☒	☒	☐	☐
Sector editor	☒	☒	☒	☒	☒
File attribute editor	☒	☒	☒	☒	☒
File finder	☒	☒	☒	☒	☒
Text finder	☒	☒	☒	☐	☒
Edit within text finder	☐	☐	☒	☐	☐
Unerase	☒	☒	☒	☒	☒
Quick unerase (last file unerase)	☐	☒	☐	☒	☒
File compression/decompression	☐	☐	☒	☐	☐
Extended filename creation	☐	☒	☐	☐	☒
DIRECTORY FEATURES					
Directory sorting	☐	☒	☒	☒	☒
Visual tree	☐	☒	☒	☒	☒
Moves files between directories	☐	☒	☒	☒	☐
DISK FEATURES					
Defect analysis	☐	☒	☒	☒	☒
Reformat recovery	☐	☒	☒	☒	☒
Defragmenting	☐	☒	☒	☒	☒
Disk mapping	☐	☒	☒	☒	☒
Backup	☐	☐	☒	☐	☐
Benchmark tests	☐	☐	☐	☐	☒
Format conversion	☐	☒	☒	☐	☐
Caching	☐	☐	☒	☒	☐
Restores damaged boot sector and partition table	☐	☐	☐	☒	☒
DESKTOP UTILITIES					
Calendar	☒	☒	☒	☐	☐
Calculator	☐	☒	☒	☐	☐
Clock	☐	☒	☒	☐	☐
Alarm clock	☐	☒	☒	☐	☐
MEMORY MANAGEMENT					
Memory mapping	☐	☒	☒	☐	☐
Uses LIM EMS 4.0 memory	☐	☒	☐	☒	☐
Saves RAM image to disk	☐	☐	☐	☒	☐
APPLICATION MANAGEMENT					
Application execution	☐	☒	☒	☐	☐
Copy protection removal	☐	☐	☐	☐	☐
SECURITY FEATURES					
File encryption/decryption	☐	☒	☒	☐	☐
Password protection	☐	☒	☒	☐	☐
Antivirus features	☐	☐	☐	☒	☐
Can wipe out files permanently	☐	☒	☐	☒	☒
PRINTER MANAGEMENT					
Printer setups	☐	☐	☐	☐	☒
LPT port adjustment	☒	☒	☐	☐	☐

—Editor's Choice

☒—Yes

☐—No

ers who are likely to install it. If you save your work often and practice safe computing, you won't need POP or the vaccine programs at all.

Along with all these rescue programs, you get a disk-testing program that's smart enough to test files before testing unused areas of the disk; a cache that runs in conventional, expanded, or extended memory; a defragmenter; a file finder that unfortunately won't let you interrupt a long search by pressing Esc or Ctrl-Break; a simple directory sorter; a keyboard accelerator; and separate programs for formatting hard and floppy disks. You can delete the hard disk formatter for safety while retaining the floppy disk formatter. And you can install any of the *Mace* programs so that users have to enter a password before accessing them. When Fifth Generation Systems (maker of *Fastback Plus*) bought Paul Mace Software, it dropped *Mace's* old backup program. It won't be missed.

All the *Mace* programs can be run from the DOS command line or from a full-screen menu that looks decent enough in color but downright ugly in monochrome. The menu deserves to look like something you would want to use often, because it has conveniences like one-key access to the DOS command line and some important operating-system functions built in.

You may not want to use *The Mace Utilities* every day, but it can get you out of hot water while other programs are vainly attempting to save the day. If you value your disk and your data, you'll value *Mace*.



The Norton Utilities, Advanced Edition

Experience counts, and Peter Norton got here before anyone else did. Peter Norton Computing's pioneering set of data-recovery tools has now matured into the \$150 *Norton Utilities, Advanced Edition*, Version 4.5, a highly integrated package of 26 separate programs. Each is a model of elegance, reliability, and efficiency.

Competing packages often throw in everything from a videotape database to a bowling-league statistician, but *Norton* concentrates on programs designed for data recovery and disk efficiency. The data-salvaging programs range from a quick automated undeleter that runs from

The Norton Utilities' sector editor includes plenty of options at the foot of the screen and warns you before it writes changes to the disk. Modified bytes are highlighted, and the smart editor won't highlight a byte that you entered at the keyboard but when it is unchanged from the byte on-disk.



the DOS command line all the way up to an elaborate Disk Doctor program that can cure damage or confusion in your disk's boot record, partition table, directories, and FAT.

A CLASSIC PERFORMER

The heart of *The Norton Utilities* is the Norton Utility, NU.EXE. This classic program has two interlocking parts: sector editor and unerase. Its sector editor lets you view or edit everything on your disk, using a variety of tools to streamline tasks such as modifying the partition table, FAT, or directories.

For ordinary files, NU's sector editor uses the standard DEBUG-style screen with hex numbers on the left and ASCII characters on the right. Unlike other hex editors, it has an Undo feature that lets you restore one or more bytes that you changed by mistake, without making you reedit the whole cluster. (Undo works only *before* you save the edited cluster to disk, of course.)

The unerase functions in NU guide you almost effortlessly through the most dangerous thickets of file recovery, even when the deleted file is split into fragments scattered across your disk.

To use NU for editing or undeleting, you simply make your choices by highlighting or pressing a letter key in a sequence of well-designed menus. You have to jump among a lot of menus in NU, but once you start taking a specific path down the menu tree, the program is smart enough to take you directly to the menu you need and move the highlight right to the item you want.

NU lets you recover deleted files either automatically or by letting the program make educated guesses that you can confirm, or—in especially difficult cases—by manually building a list of clusters that contain the data from the lost file.

If you install *Norton's* Format Recover program (FR), you'll almost never have to undelete files manually. FR's official function is to store a copy of the FAT and root directory in order to restore a disk after an accidental format. In the DOS 3.x and 4.x era, disks rarely get formatted accidentally, so FR's data is used mostly by the Quick Undelete program to locate and restore all the fragments of a deleted file.

You'll need manual undeletion only if you must restore an old version of a since-revised file or if you have to restore a badly

PC FACT FILE EDITOR'S CHOICE

The Norton Utilities, Advanced Edition, Version 4.5

Peter Norton Computing, 100 Wilshire Blvd., 9th Floor, Santa Monica, CA 90401; (213) 319-2010. List Price: \$150 (Standard Edition, \$99.95).

Requires: 256K RAM, DOS 2.0 or later.
In Short: Norton's classic package has the most comprehensive set of tools for hard disk safety and data recovery, as well as well-designed convenience programs such as text-searchers and batch-file enhancers. It's elegant and indispensable, although it can't cure all the disasters curable by *Mace*.

CIRCLE 398 ON READER SERVICE CARD



fragmented file on a disk where FR hasn't been run recently or at all. Manual undeleting is not something to try in a state of panic because you really have to think about what to enter in some menu fields, but a witty tutorial provides a full combat simulation.

INDISPENSABLE FEATURES

Norton is indispensable even if you never lose a file. An improved CD command lets you jump to any directory without entering backslashes or the full directory name.

SOFTWARE DOS UTILITIES

Other well-designed utilities in the package include a text searcher, a file finder, and a file-attribute modifier. The defragmenter offers all the essential file-organizing options, the directory sorter is the most flexible of its kind, and the format program lets you stop worrying about the absurdly complicated parameters of DOS's FORMAT command. A disk-test program digs deeply enough to find most problems, and a data-security module completely over-

writes files or erased disk space to make recovery impossible.

Norton offers some true luxuries as well: a batch-file enhancer that, among other things, draws windows on-screen for your menus and even plays brief tunes. A control center adjusts screen colors, video modes, cursor size, and keyboard speed. The notorious System Information command flatters your ego with a wildly inflated speed-test figure for the your computer.

All the *Norton* programs can be run from a single menu that displays the syntax

THE SPECIALISTS: Top Choices Among Single-Purpose Utilities

by Edward Mendelson

Each of the packages reviewed in this roundup contains a dozen or more programs. You won't find better sector editors or file undeleters anywhere else than in these products, but for a few extra dollars you can find substantially better examples of some of the other utilities, especially if you're looking for the ideal disk cache, defragmenter, or backup program.

A **cache** stores in RAM any data recently accessed on your disk, working on the principle that if you needed it once, you'll need it again. It's a lot faster getting data out of RAM than from the disk surface, and with disk-intensive applications like databases, the difference in speed can be startling. Even

with ordinary applications a cache hurries access to data by reading it from the disk even before DOS asks for it and then supplying it from memory.

When *PC Magazine* reviewed disk caches about a year ago (see "Getting the Most Out Of Memory," February 14, 1989), Multisoft's \$79.95 *Super PC-Kwik* was the Editor's Choice champion. It still is. This swift, safe program installs itself effortlessly but offers enough options to let you customize it for any special balance of its various benefits. One option the program fortunately does *not* include (but found in some other programs) is the ability to tell the cache to delay writing to disk. If you switch off your machine during the delay permitted by these oth-

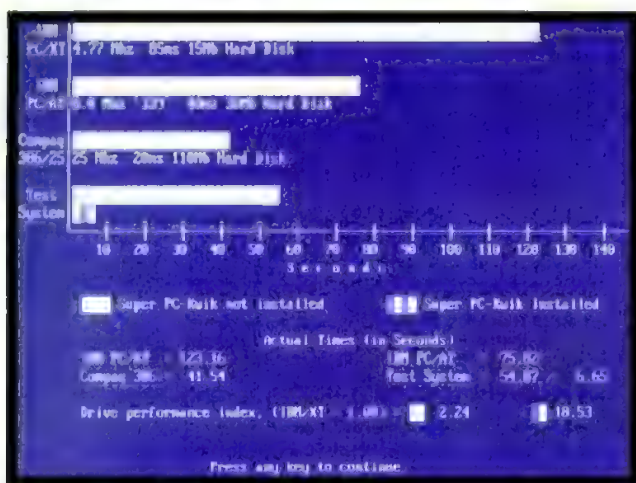
er programs, you can lose massive amounts of data.

Multisoft Corp. includes *Super PC-Kwik* in its \$129.95 *PC-Kwik Power Pak*, a product that lets the cache share expanded memory with a print spooler, RAMdisk, and a screen-recall program. It dynamically alters each one's share of the memory pool depending on which you need most.

A **defragmenter** speeds disk access by reuniting broken fragments of your files so that DOS doesn't have to jump around the disk to find them. It can also place program files and directories at the front of the disk for faster access.

PC Magazine's Editor's Choice in a late-1988 survey of defragmenters (see "Order Out Of Chaos: Boosting Performance with a Well-Ordered Disk," October 11, 1988) was Bridgeway Publishing Co.'s \$49.95 *FastTrax*. Nothing matched its combination of safety and speed, and nothing approached its range of options. *FastTrax* lets you customize the location of every file on-disk and even lets you place deliberate "holes" in your disk as a way of controlling fragmentation. A separate utility helps you build a control file for its various options without tediously typing in all the information required. *FastTrax* is still the best defragmenter, but Multisoft is about to offer a challenge in the form of its \$79.95 *PC-Kwik Power Disk*.

You don't need to be told why you need a **backup program**. The two choices of *PC Magazine*'s editors a few months ago (see "Backup Software: For the Moment After," August 1989) were Fifth Generation Systems' \$189 *Fastback Plus* and Sterling Software's



Multisoft's *Super PC-Kwik Disk Accelerator* includes its own benchmark that enables you to see how much faster your disk operates when the utility has been installed.

and parameters of each. Many of the programs have built-in help screens, sometimes limited to a brief description of available keystrokes. More-detailed help screens in NU offer good-natured warnings about the damage you can do by modifying sectors.

All 26 programs use a consistent command-line syntax that sensibly matches DOS's, wherever possible. If, for example, you want to search for text in the current directory and all lower-level directories as well, you merely use the same /S

SOFTWARE DOS UTILITIES

parameter that DOS uses to specify "use subdirectories also."

DISK DOCTOR ON CALL

The Norton Disk Doctor is sometimes less effective at fixing extreme damage than *The Mace Utilities'* Emergency Room; unlike *Mace*, it can't undo its own treatment if it misjudges your disk's symptoms. But this pioneering utility belongs in everyone's personal clinic of disk utilities for the

very reason that the exact nature of disk disorder is unpredictable—one physician's technique may produce results when another's doesn't.

In the first release of Version 4.5, Disk Doctor worked with some nonstandard disks and lacked some of the finesse of the second release. If your Norton files are time-stamped 4:50pm, you have the first release and should probably get an upgrade; a time-stamp of 4:51pm indicates the current release. Copies time-stamped 4:51 but with *dates earlier* than December



FACT FILE

DMS/IB,
Version 3.2
Sterling Software,
202 E. Airport Dr.,
#280, San
Bernardino, CA
92408; (714) 889-
0226.

List Price:
\$149.95.

Requires: 320K RAM, DOS 2.0 or later.
In Short: A luxurious, logical, and effortless backup package with the easiest restores on the market. Slower than competing packages, but produces better-organized backup disks.



CIRCLE 401 ON READER SERVICE CARD

FastTrax,
Version 3.9
Bridgeway
Publishing Co.,
2165 E. Francisco
Blvd., Suite A1, San
Rafael, CA 94912;
(415) 485-0948.
List Price: \$49.95.

Requires: 192K
RAM for 21MB
disks, 256K for 32MB disks; DOS 2.0 or later.
In Short: A safe, flexible, and fast disk packer with unique optimization methods and a wide range of options.



CIRCLE 402 ON READER SERVICE CARD

\$149.95 *DMS/IB* (formerly *Intelligent Backup*). For breathtaking speed combined with the ultimate in reliability, choose *Fastback Plus*. For a well-organized backup strategy that automatically renews your backups on a single set of disks, choose *DMS/IB*; the program also lets you restore earlier versions of files via a one-step command at the DOS prompt.

Another backup program about to appear from a company that knows a lot about hard disks: Peter Norton Com-

puting's *Norton Backup*. Check the First Looks section in future issues for a review.

NO-COST WINNERS

Some of the best utilities can be found for free—right in the pages of *PC Magazine*. In every issue we publish a utility to help you gain a better understanding of your system. What's more, *PC Magazine's* utilities are always available on PC MagNet, our on-line information service.

Among these utilities are DCACHE (a memory-resident hard disk cache that speeds disk input/output) and CHKFRAG (which reports the extent of file fragmentation on a hard disk and also provides an ERRORLEVEL value usable within a batch file to call a defragmenting program). Listed below are some of the many other offerings you can find on PC MagNet:

■ **ATTR**—A utility that permits display and modification of the archive, system, hidden, and read-only file attributes.

■ **CO**—This program copies, moves, or deletes files individually or in tagged groups from directory listings (which can be sorted by name, extension, size, or date). When called up, CO presents an alphabetized listing of the current directory with a menu of function-key commands on the right.

■ **EMS40.SYS**—A device driver that emulates the Lotus/Intel/Microsoft Expanded Memory Specification (Version 4.0) in software, permitting extended memory in AT-class machines to be used as expanded memory.

■ **SLICE**—This program spreads a DOS file too large to be copied onto a single floppy disk across multiple diskettes, enabling the file to be easily re-



FACT FILE

Fastback Plus,
Version 2.09,
Fifth Generation
Systems Inc., 11200
Industriplex Blvd.,
Baton Rouge, LA
70809; (800) 873-
4384, (504) 291-
7221.

List Price: \$189.

Requires: 330K RAM, DOS 2.1 or later.
In Short: Top-speed performance, clear menus, and every imaginable option—even built-in macros—all combine to make this the best general-purpose backup program.



CIRCLE 403 ON READER SERVICE CARD

Super PC-Kwik,
Version 3.32
Multisoft Corp.,
15100 SW Koll
Parkway, Suite L,
Beaverton, OR
97006; (503) 644-
5644.

List Price: \$79.95.

Requires: 64K
RAM, DOS 2.0 or
later.

In Short: The fastest cache tested, with the most useful set of options, small memory usage, and high reliability.



CIRCLE 404 ON READER SERVICE CARD

stored to a second machine.

■ **XPANDISK.SYS** and **XPAN-BOSS**—A device driver that allows for variation in the amount of expanded memory allocated to a RAMdisk without requiring a reboot. It is designed for systems equipped with memory that conforms to the Lotus/Intel/Microsoft specification.

■ **ZCOPY.COM**—Using this program, you can transfer files at high speeds—via a serial link—between machines that do not share a common disk format. ■

Now Peter Norton

If you've ever seen the words "GENERAL FAILURE ERROR" on the screen of your PC, you know you don't need to be ill to feel sick.

All you need is a corrupted disk with some valuable data stored aboard.

When that happens, it's time to call on the remarkable new *Norton Disk Doctor*™.

The Norton Disk Doctor is one of 27 data recovery and disk management tools in the latest Advanced Edition of the Norton Utilities®.

It's also the most significant advance in utility software technology since Peter Norton first began saving the data and the derrières of grateful PC

C> FILE NOT FOUND!

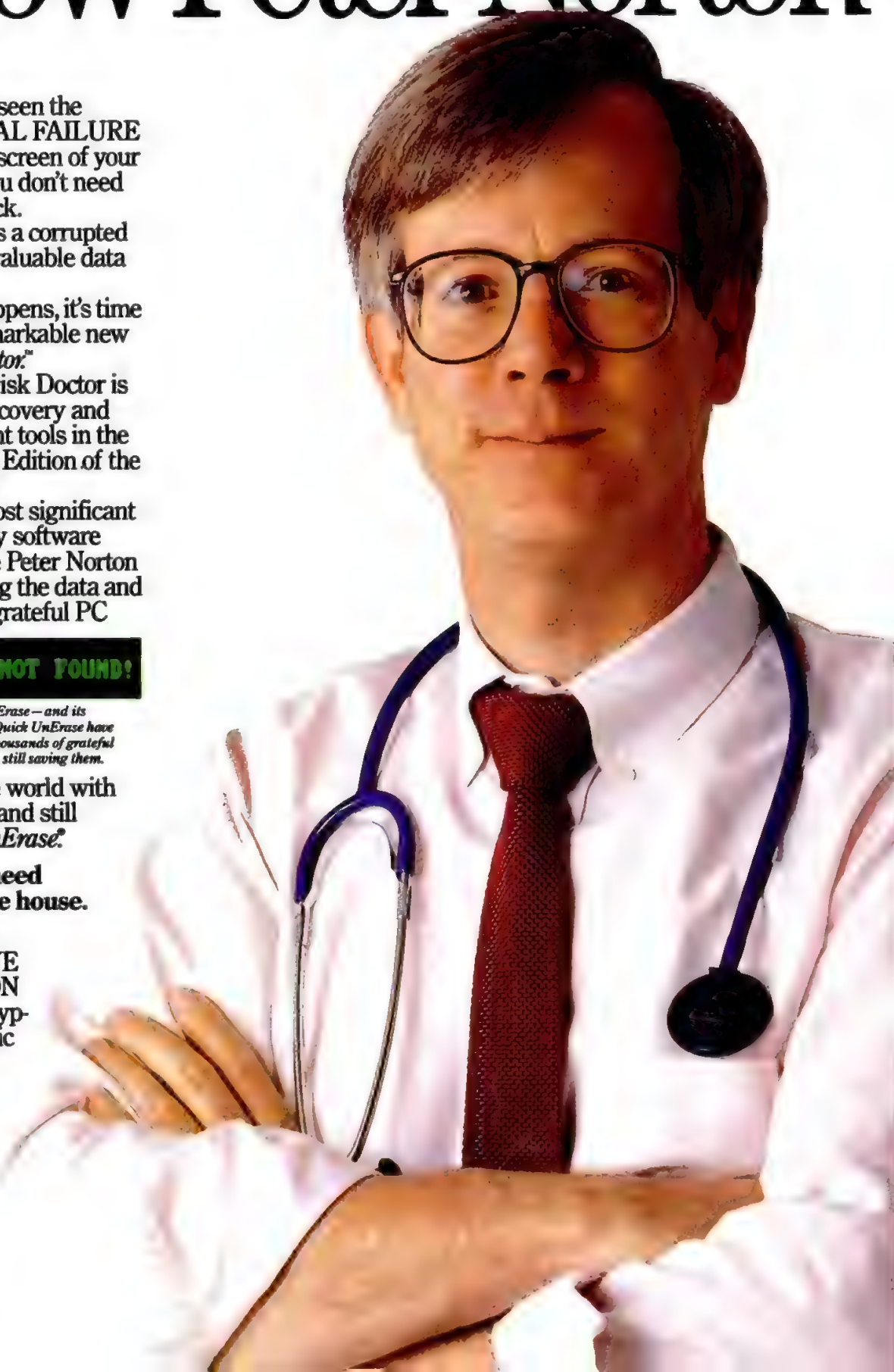
Our legendary UnErase — and its short-cutting offspring Quick UnErase have saved the derrières of thousands of grateful PC users. And they're still saving them.

users around the world with the legendary — and still unequalled — *UnErase*®.

**Why you need
a Doctor in the house.**

Now, whenever INVALID DRIVE SPECIFICATION or some other cryptic or catastrophic error message appears on your screen, you can do something besides reach for the Maalox®.

You can summon the Disk Doctor, which will



makes house calls.



The Standard Edition gives you UnErase, the new Norton Control Center and a range of features, functions and enhancements.

determine the exact nature of the problem, report it and, in most cases, fix it for you.

All by itself.

The Disk Doctor can diagnose and repair everything from bad partition tables and boot records to mangled root directories. It can even reformat bad sectors and write back the old data.

Automatically.

In fact, if the Doctor can't cure your corrupted floppy or hard disk, then Buster, you've got one corrupt disk.

In which case, you'll need to refer to *The Norton Troubleshooter*, a 158-page guide to finding and fixing most anything that could go wrong.

Don't worry, you don't have to go to the bookstore or the library to refer to it, because the Troubleshooter is included in the Advanced Edition.

Frankly, the Norton Disk Doctor and the Norton Troubleshooter are worth the price of the new Advanced Edition all by themselves.

But, of course, they aren't by themselves.

They're accompanied by a wish list of features, functions and enhancements sufficient to satisfy the yearnings of all those people who've been politely writing and calling to request them.

The people's choices.

Like *Speed Disk*, the world's most powerful disk tuning tool, which features four user-selectable optimization methods and doesn't lose your data if you lose power.

And *Format Recover*, which can unformat your accidentally reformatted hard disk even if you haven't taken any precautions beforehand.

Our user interface, which *InfoWorld* said made the Utilities "as easy to use as possible," now comes with pop-up windows and dialog boxes.

Our new *Norton Control Center* lets you define or alter a range of system settings—from cursor size to screen and palette colors—quickly and easily.

While our *Disk Test* finds and marks faulty areas on your disk to help you protect your data before you have a chance to lose it.

If you want to lose it, however, you'll be glad to know that *WipeFile* and

WipeDisk support DoD 5220.22-M 116c(6b), the Pentagon's latest data security specification.

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COMPUTING

All Utilities now support large hard disks under DOS 4.0, COMPAQ DOS 3.31, and the PC-MOS/386 multi-tasking operating system. Designed for the IBM® PS/2 and PC families and 100% compatibles. © 1988 Peter Norton Computing, Inc. 100 Wilshire Blvd., 9th Floor, Santa Monica, CA 90401-1104



The Norton Disk Companion is included, free, with both the Standard and Advanced Editions. The Norton Troubleshooter is yours with the Advanced Edition.



NORTON UTILITIES
ADVANCED EDITION
VERSION 4.0

1989 have trouble restoring boot sectors on disks formatted with the most recent version of DOS 4.01—that version includes files dated April 1989. When I discovered this problem, Norton immediately modified the Disk Doctor. If you don't want to spend the money on an upgrade, Norton has prepared an information sheet that lets you solve the problem manually.

The Norton Utilities, Standard Edition, at \$99.95, omits some programs that modify disks and thus may be safer for less expert users. But you're playing with fire if you don't have this or the *Advanced Edition* on your disks and the disks of everyone with whom you work. Recently I walked a nontechnical user through a manual recovery of three fragmented files with NU, simply by giving instructions over the telephone. I wouldn't consider trying that with a file-recovery program written by anyone but Peter Norton.



PC Tools Deluxe

If it's been a few years since you visited Central Point Software's \$129 *PC Tools Deluxe*, you'll be amazed by its transformation. Where once you found powerful but gritty machinery for maintaining and salvaging files and disks, you'll now discover a sleek showroom for all the latest conveniences. All the old strength is still there, but you no longer worry about getting your hands dirty.

Like any fashionable mall, *PC Tools Deluxe* is built on two levels. The main level is now a Desktop program that can be left in memory as a 43K TSR while you run other applications. When you pop up the Desktop by pressing a customizable hotkey, you get the use of financial and scientific calculators, notepads, a miniature database, an outliner, an appointment calendar, and an alarm clock. You also get ProKey-compatible keyboard macros and a moderately powerful background telecommunications module that needs some work before it becomes trouble-free.

From the Desktop, you have direct access to the second level—a Shell program that houses all the file and disk services and also serves as a customizable launcher for any other application. Like the Desktop, the Shell can be run as a TSR (requiring a mere 10K), or as a standalone that ignores the Desktop altogether. When you

SOFTWARE DOS UTILITIES

pop up the Shell, it swaps to disk or expanded memory any additional RAM occupied by the underlying application that the Shell itself needs to run. Only when the Shell is run as a standalone program can you launch applications from it, so you can't use it for task switching.

On a 386, I was unable to load the Shell or Desktop into high memory in order to avoid using up any DOS memory at all. However, Innovative Data Concepts' SWAPSH and SWAPDT utilities (\$25 each, \$45 for both) let you load most of both Shell and Desktop into expanded memory so that you need only 7K of DOS RAM for each—and they load faster in the bargain. Contact Innovative Data Concepts, 1657 The Fairways, #101, Jenkintown, PA 19046; (215) 884-3373.

SHELL SERVICES

The Shell normally displays a directory screen with a tree on the left and a list of files on the right. You can split the screen in two and display separate drives or directories at once. A one-line drop-down menu at the top of the screen and a separate two-line menu at its foot offer options that can overwhelm beginners but quickly grow manageable. The menus can be used with the keyboard or a mouse. Although the keyboard normally offers the faster interface, some menus slow it down by forcing you to use the Tab or Arrow keys to move among options.

When you select a file from the directory screen, you can copy it, delete it, change its attributes, view it, or edit it. You can search the disk for files or search

files or the entire disk for text. A directory-maintenance feature lets you prune one branch of the tree and graft it to another point on the tree. A text-file editor offers convenient search-and-replace and block moves and copies, but the separate hex editor inconveniently refuses to let you search for the characters that you might want to modify.

PC Tools Deluxe lacks the special editing tools that Norton supplies for the FAT and directories and doesn't let you touch



**PC Tools Deluxe comes
with a complete suite
of disk utilities—more
than you get with
competing packages.**



your disk's master boot record or partition table. For most users who are rightly terrified of going near those places, these omissions are an advantage. But experts will need to supplement *PC Tools* with more-advanced toolkits.

If you periodically run Mirror, *PC Tools'* format-recovery program, the undelete function of Shell will have an up-to-date copy of the FAT that it can use for perfect recovery of lost files. No command-line undeleter is provided, so you have to work your way down through

CONTINUES

When you recover a deleted file manually in *PC Tools Deluxe*, you can choose all necessary functions from the foot of the screen, which saves you from the confusing menu-jumping required by other programs.



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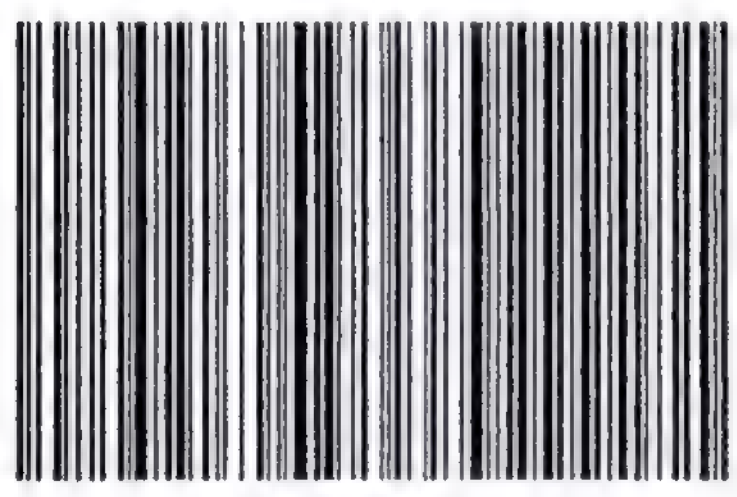
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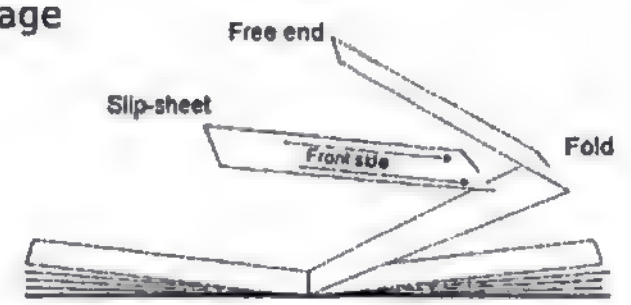
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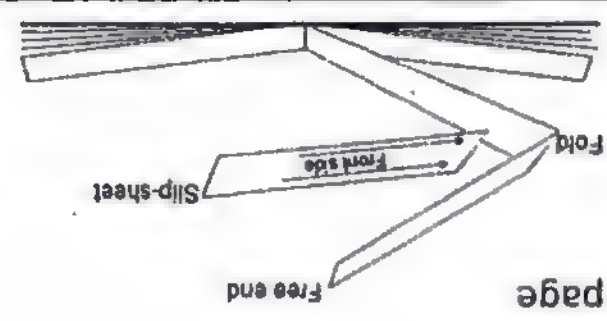
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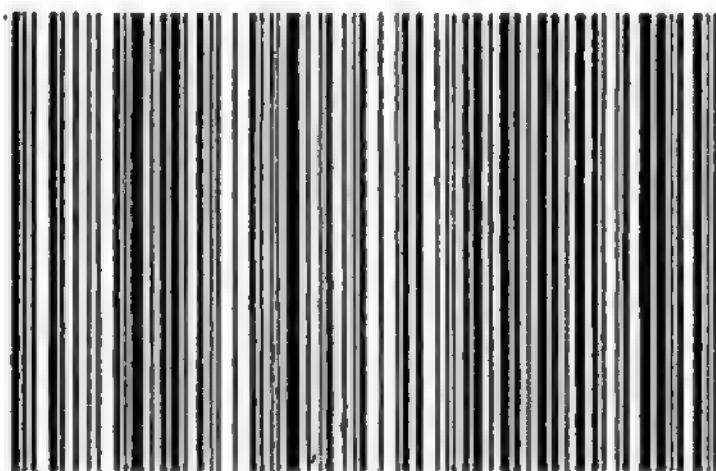


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These are the attributes which *PC Magazine* used in awarding ZEOS the coveted Editor's Choice, not once but three times. And "Overall Excellence" are the very words *PC Magazine* used in describing ZEOS systems comparing them to all others.

Reason #2

Dazzling Performance.

In one recent '386 review, *PC Magazine* awarded ZEOS Editors Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

Dazzling Performance is built into every ZEOS system. It's a key component of ZEOS Overall Excellence.

Reason #3

Exceptional Quality.

PC Resource Magazine put it this way, "ZEOS... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

Reason #4

Value.

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Value: Excellent."

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Reason #7

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ZEOS has been involved in Research and Development since our incorporation back in 1981. Our strong and experienced Research, Manufacturing and Technical Staff translates into superior factory direct computer systems for you.

Reason #8

A Sterling Reputation.

In magazine after magazine and review after review ZEOS systems are cited for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

Reason #9

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Requested Line of Credit \$ _____

Your Name _____ Date of Birth _____
First Initial Last Mo. Day Yr.

Present Address _____
Street Apt. # City State Zip

Social Security Number _____ Home Phone _____

Date of Residence _____ Monthly Payment \$ _____ ☐ Buy ☐ Rent ☐ Other
Month Year

Previous Address _____

Dates of Residence _____
From To

Your Employer _____
(If self-employed, see rear panel.)

Date of Employment _____ Position _____
Mo. Yr.

Monthly Income _____
Gross \$ Net \$

Employer's Address _____
Street

City _____ State _____ Zip _____ Business Phone _____

Previous Employer _____ Address _____

Dates of Employment _____
From To

Other Income _____ I have received since (Date) _____
Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation.

Monthly Income _____
Gross \$ Net \$

Name and Address of Nearest Relative Not Living With You _____

Relationship _____

b. Credit Information

Include joint information, if joint account requested.

Bank Account _____ ☐ Checking ☐ Savings
Bank Name

Address _____

Bank Account _____ ☐ Checking ☐ Savings
Bank Name

Address _____

Bank Loan Reference _____
Bank Name Address

Payment _____ Balance _____

Bank Card Reference _____
Bank Name Address

Payment _____ Balance _____
☐ VISA ☐ Mastercard

(please check appropriate box):

☐ **Joint Credit** with another person. Complete all information.

☐ **Individual Credit** but rely on income or assets of another person as a basis for repaying the credit requested. Complete all information

☐ **Individual Credit** Complete sections "a" and "b" only.

Please complete all appropriate sections, *providing at least two years' residence and employment history*. This will enable your information to be processed as quickly as possible. If you are self-employed, please be sure to complete section "d" below.

Other Credit Card Reference _____
Bank Name Address

Payment _____ Balance _____

Other Credit References _____ Payment _____ Balance _____

Account No. _____ Expires _____

Driver's License No. _____ State _____ Expires _____

c. Joint Personal Information

Joint Name _____
First Initial Last

Date of Birth _____ Social Security Number _____
Mo. Day Yr.

Address _____
Street Apt. #

City _____ State _____ Zip _____

Date of Residence _____ Home Phone (_____) _____
Mo. Yr.

Employer _____

Date of Employment _____ Position _____
Mo. Yr.

Monthly Income _____
Gross \$ Net \$

Employer's Address _____
Street

City _____ State _____ Zip _____ Business Phone _____

d. Self-Employed Information

Complete this section only if you are self employed.

Business Name _____

Business Address _____

☐ Proprietorship ☐ Corporation ☐ Partnership Business Phone (_____) _____

Description of Business _____

Your Position _____ In Business Since _____

Your annual income from business _____ Business' annual income _____
(gross) (net)

You must provide at least one of the following:

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(_____) Telephone _____ Personal Banker's Name _____

2. Accountant's Name _____

(_____) Telephone _____

3. Financial statement on business attached.

(EXC. AK, & HI)

PC FACT FILE EDITOR'S CHOICE

PC Tools Deluxe, Version 5.5
Central Point Software,
15220 N.W. Greenbriar
Pkwy., #200,
Beaverton, OR 97006;
(503) 690-8090.
List Price: \$129.
Requires: 512K RAM,
DOS 3.0 or later.
In Short: PC Tools

combines disk-maintenance utilities with an application launcher and a desktop packed with calculators, notepads, outliners, and other conveniences. The file-recovery and disk-editing tools are less powerful than those in competing packages, but no other utility package contains such a wide variety of effective and well-designed programs.

CIRCLE 399 ON READER SERVICE CARD



Shell's menus. But if you have to recover a file manually, the Shell's menus make the task easy—often easier than with *The Norton Utilities*.

When you put together a file from data scattered around the disk, the program displays a series of clusters chosen either, by searching for a string that you specify or simply by moving from one cluster to the next. As each cluster appears, you simply press a key to add the cluster to the file or another key to skip it and look at another. Only a few lines of the file appear on the screen at a time, but you don't have to jump back and forth among menus as you do with *Norton*. Version 5.5 of *PC Tools* doesn't include a disk-salvage program like *Norton's Disk Doctor* or *The Mace Utilities'* Emergency Room, but one is promised for Version 6.0, due to arrive this spring.

PC Tools Deluxe comes with a complete suite of the major disk utilities designed for everyday use—more than you get with competing packages. The cache, which works in any kind of memory, is a reduced version of *Super PC-Kwik*, a *PC Magazine* Editor's Choice. The backup program, completely rewritten from earlier versions, is solid, flexible, and swift. The defragmenter is safe and moderately fast, and has a good range of sorting options. It is misleadingly named *Compress*, but the package also includes a *real* file-compression function as part of an encryption program.

PC Tools Deluxe is a remarkably impressive performer in dozens of areas. No other package offers nearly as many well-designed utilities—all with a consistent in-

SOFTWARE DOS UTILITIES

terface—for so reasonable a price. For the most-advanced data recovery and disk maintenance, you should supplement *PC Tools Deluxe* with other packages. But you will discover that you can get an astonishing amount of work done if you own *PC Tools Deluxe* and no other utilities or application programs at all.



Take Charge!

Don't be deceived by the miniature box in which Departmental Technologies packs its \$99.95 *Take Charge!* That tiny box turns out to be a veritable warehouse of utilities, and the warehouse comes loaded with a resident disk-maintenance staff ready to go to work at the press of a hotkey.

When you first run *Take Charge!*, Version 1.30, it makes itself resident in 23K of RAM. Two different hotkeys swap to disk whatever application you happen to be running and bring up one of two menus. The first menu is a customizable platform for launching applications and utilities of your choice even while running another DOS application. If you have other utilities that can be run as TSRs or standalone programs but are really too large for practical use as TSRs, you may instead install them as standalones on the application-launching menu and let *Take Charge!* swap out the RAM needed to run them at

any time. However, because *Take Charge!* swaps to disk, not EMS, swapping is somewhat slower than it is with dedicated task-switching programs like *Software Carousel* or *Headroom*.

The second menu leads to the multitude of utilities supplied with *Take Charge!* These include an alarm clock, a calendar, a notepad, and a communications module that supports Xmodem file transfers. A calculator module doubles as a straightforward adding machine and a reverse-Polish-notation device with extensive financial, statistical, and programmer's functions built in. An elegant Rolodex-style database includes file-access controls when you order the optional network version of *Take Charge!*

Many of these modules are linked to the package's extensive file and disk utilities. The file utility screen offers all the standard directory functions, including attribute editing, file viewing, and hex editing, plus searches for filenames and text strings. You can also format or compare disks and find the space needed to store a tagged set of files.

A submenu takes you to the disk functions and provides a brief help screen specifying parameters for each. The disk functions comprise a reasonably full collection of sturdy utilities, including a defragmenter with limited options, a disk tester, and programs to wipe out a file or disk beyond hope of recovery. You don't get a cache or backup program, and the directory editor included in the earlier versions of *Take Charge!* has now been removed, because corporate users often regard that



The sector editor in *Take Charge!* includes a convenient search command, but you can search only for ASCII strings. Its undo function restores the entire sector, not the byte under the cursor—a more useful function provided by *The Norton Utilities*.

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CIRCLE 250 ON READER SERVICE CARD

kind of program as too dangerous to let loose in the office.

Take Charge!'s interface varies from program to program, sometimes using Lotus-style menus, sometimes using function keys, but each menu is always clear and intuitive. Virtually the only time I needed to use the manual was when I looked up the keystrokes required to mark a block to cut-and-paste into the memory-resident clipboard.

RECOVERING FILES

Among the advanced disk functions in *Take Charge!* is an undeleter that works automatically or interactively. The automatic mode lets you select one or more deleted files from a directory display and then tries to recover the file. If automatic recovery fails, you can turn to the interactive mode, where you page through a DEBUG-type display of available data clusters and select the ones you want to include in the recovered file. When you're through making your selections, a review function lets you view the file in a more easily readable text display. If you want to change the list of selected clusters, you have to start over—you can't edit the list as you can with *The Norton Utilities* and *PC Tools Deluxe*.

A format-recovery program insists on saving its image of your disk's FAT to a floppy disk drive. In contrast, *The Mace Utilities*, *Norton*, and *PC Tools* leave the FAT image on the hard disk and can locate it even after the disk has been formatted. Because *Take Charge!* doesn't take advantage of the stored FAT image when recovering deleted files, automatic undeletes of fragmented files are less likely to succeed



EDITOR'S CHOICE

- **Disaster Recovery:**
The Mace Utilities
- **General Disk Maintenance:**
The Norton Utilities, Advanced Edition
- **Range and Ease of Use:**
PC Tools Deluxe

Disk utility packages are among the top sellers of all software, and the chief beneficiary of this fierce competition is your data. Both *The Mace Utilities* and *The Norton Utilities, Advanced Edition* can automatically repair damage that would have been fatal to disks and data only a few months ago. The newest version of the easy-to-use *PC Tools Deluxe* should have similar abilities this spring. And all three packages include numerous other functions—some of them indispensable.

For the safest and fastest data recovery, the latest version of *The Mace Utilities* is the best choice. *Mace* refuses to write anything to a disk without giving you a chance to reverse the procedure afterwards, and it comes with specialized programs for restoring word processing and database files. Although the package is getting an interface overhaul, it still looks and feels clumsy—the interface on the *Mace* sector editor makes it excessively dangerous in unskilled

hands. *Mace*'s main recovery is safe in any hands and is today's top surgeon in the field of disk recovery.

The Norton Utilities, Advanced Edition has all the data-recovery functions you'll ever need in an elegantly integrated set of programs. The directory-changing program alone is worth the price of the package, and all its programs are models of functionality and design. Undeletes are fast and reliable, and the sector editor has several more conveniences and safety features than any other; it is also able to edit parts of a disk that other sector editors can't even touch.

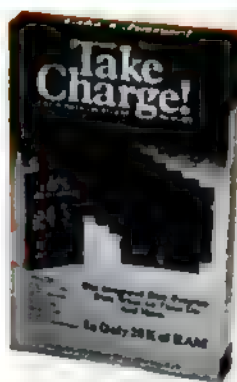
PC Tools Deluxe, with its character-based graphics and mouse-aware interface, currently lacks the advanced data recovery of its rivals. However, if you have to recover a deleted file manually, it lets you do the job with the least difficulty. The package includes a cache, a defragmenter, and a backup program, a set of well-designed memory-resident desktop utilities, and a complete memory-resident DOS shell. Its sector editor is only adequate, but the *PC Tools Deluxe* package as a whole is the most extraordinary bargain in the PC marketplace, especially for PC users less knowledgeable of their machines' inner workings.



FACT FILE

Take Charge!
Version 1.30
Departmental
Technologies Inc., P.O.
Box 645, Andover, NJ
07821; (201) 786-6878.
List Price: \$99.95.
Requires: 325K RAM,
DOS 2.1 or later
(partitions over 70MB not supported).

In Short: *Take Charge!* combines a memory-resident application launcher that can be popped up over other applications and a fairly powerful set of disk and file utilities, both available at the touch of a hotkey. The package is less carefully polished than its rivals, but it's sturdy and reliable. The new Rolodex-style database is exceptionally impressive.



CIRCLE 400 ON READER SERVICE CARD

than they are with these rival programs. Although *Take Charge!* works under DOS 4.0, the disk utilities refuse to do anything with logical drives larger than 70MB, another limitation not present in rival programs.

But the competitors don't offer some of the safety features built into *Take Charge!* You get the option to trap Ctrl-Alt-Delete so you can't reboot accidentally. You can lock the keyboard with a password or blank the screen after any interval of inactivity.

The same system-setup screen menu that offers these options lets you increase the size of the keyboard buffer, change the keyboard repeat rate, and even turn on an artificial keyboard click. A command stack lets you reuse commands you en-

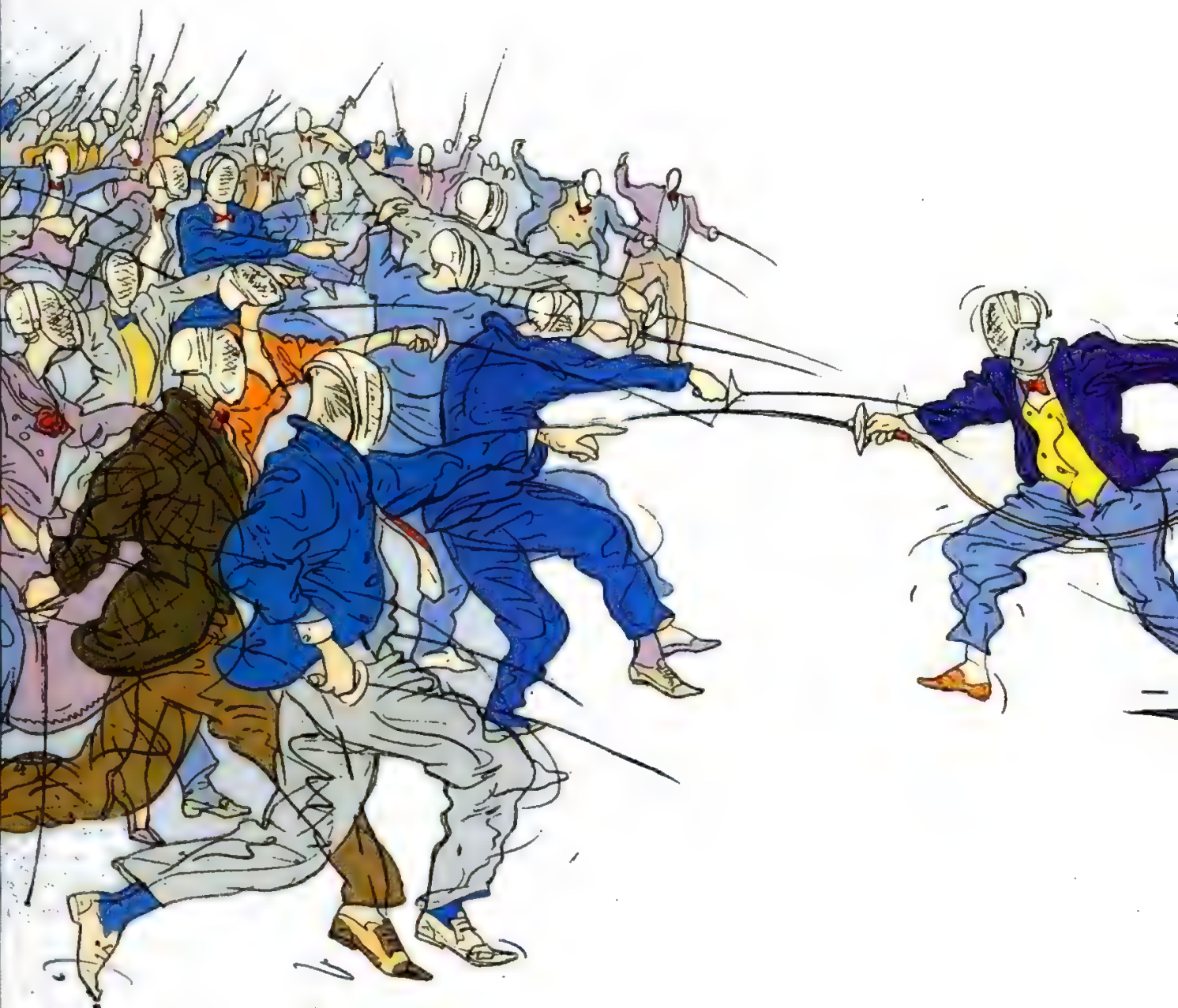
tered earlier at the DOS command line.

If you don't want to use *Take Charge!* as a TSR, you can run most of its disk utilities as standalones from the DOS command line, but it is as a TSR that the program really shines. Its overall approach resembles that of the slicker *PC Tools Deluxe*, but *Take Charge!* has the advantage of letting you launch an application from its memory-resident menu while running another application from the DOS command line. This task-switching feature, combined with extensive disk and file utilities, not only makes *Take Charge!* unique but ensures that some users will find it absolutely indispensable. ■

Edward Mendelson is a contributing editor of PC Magazine.

In The 90s,
Your Company
Must Learn To
Thrive Amid
Unprecedented
Change.

As Global Competition Systems Must Change To



Intensifies, Information A Competitive Weapon.

Increasing global competition and growing market expectations are confronting business with accelerating change, change that is reshaping the way businesses operate and compete.

The role of information systems in meeting these business challenges is changing, too, from a service function to a true competitive weapon.

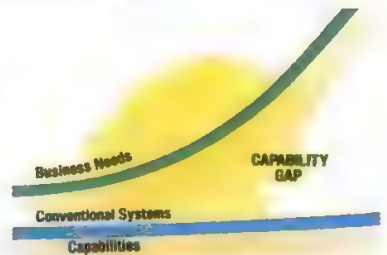
Conventional computing strategies can't provide the capabilities needed for this transition. In fact, the gap between what business needs and what conventional systems can offer is continuing to widen.

Microprocessor-based systems, open networks, and industry-standard software now offer a compelling economic alternative to conventional architectures. But there is a need for a new computing strategy that will transform traditional computing environments.

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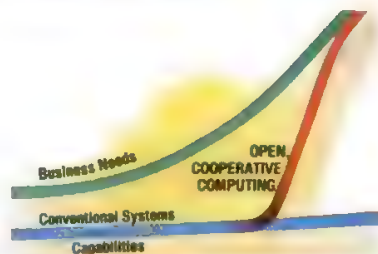
Open, Cooperative Computing allows you to transform the role of information systems. It's an open blueprint that guides you from the conventional architectures of the past to the cooperative environment of the future.

It's a strategy designed to close the gap between what your business needs from information systems and what current systems can provide.

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Our Vision Of The Begins With A Br



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*Survivors:***DESKTOP
PLOTTERS****Face The Competition**

The technology of desktop plotters hasn't leapt ahead with the rest of the PC industry, but their low cost, flexibility, and high resolution are keeping them competitive with more-glamorous color page printers. PC Labs tests ten desktop models.

by Winn L. Rosch

In a world in which technologies change so quickly, plotters remain resolute and steadfast. In less than a decade microprocessors have raced ahead, reaching speeds 20 times as fast as their original speeds; in the same time, printers have gone from hammers to lasers; hard disks have grown from 5 megabytes to 500 megabytes; and plotters . . .

Well, plotters today look the same as they did yesterday, they work the same, and they deliver nearly the same results. However, subtle electronic and philosophical changes have been made. And more importantly, to-

day's desktop plotters are just as useful as they ever were, notwithstanding a broadside of new competition from every quarter, including color page printers and color ink jets (see the sidebar "What Desktop Plotters Are Up Against").

METES AND BOUNDS

Generically speaking, a desktop plotter is anything that plots as it sits upon your desk. For the purposes of this story, however, we're restricting our nomenclature to include machines that handle d. afting media of

Illustration: Doug Archer

ANSI (American National Standards Institute) A-size (metes and bounds measuring 8.5 by 11 inches) and/or B-size (11 by 17 inches). Within that limit fit a number of very useful devices, any of which can translate the output of a CADD program into a hard-copy rendering or ink out colorful presentation graphics. Most of the companies whose plotters are evaluated here also manufacture free-standing plotters that draw huge architectural plans, project management charts, and the like with great speed and typically cost between \$4,000 and \$8,000.

Desktop plotters offer the highest resolution of almost any hard-copy device that you can plug into your PC, typically addressable to one-thousandth of an inch. With such high accuracy, they can sketch smooth curves and skew lines without a trace of jaggedness. They're quick enough to serve either as your only graphic output device or, in major installations, cheap enough to attach to workstations to take the load off a larger plotter when drafts are all that's required.

The subtle changes that have been made to desktop plotters over the last few years have made them more accessible, more usable, and generally more compatible with you and your software. While plotters work the same way they always have—they simply control the movement of an ink pen across one or another drafting medium—they've become smarter, and so have their makers.

Most plotters today are microprocessor based. The smartest process the instructions they receive to move their pens as economically as possible, optimizing pen travel and pen selection to waste the least time. And manufacturers have wised up and adopted Hewlett-Packard's HPGL plotter language for controlling their products. (All ten plotters in this review understand HPGL.)

BEDTIME STORY

Plotter technology itself is unchanged, and products are divided into two families: flatbeds, or x-y plotters, and rollerbeds, or drum plotters. The difference is simply a matter of what moves.

The flatbed plotter is the magic moving hand in action. The plotting medium is held fast against the flat plotting surface (the "bed" of the "flatbed" name), and the mechanism moves the pen across the paper in two dimensions (the "x" and "y" of the alternate name), just as you would draw a picture by hand.

The rollerbed plotter restricts its pen to traveling in one dimension—laterally across the width of the drafting medium—and moves the paper. That is, to draw lines perpendicular to the movement of the pen, the paper slides underneath the pen. The "roller" in the bed is a cylinder or drum underneath the paper that supplies the motive force.

Neither technology is an all-around winner. When price counts, the flatbed design is the low-cost winner. Building an accurate flatbed is inherently less expensive because it requires control over only one mechanism: the one that moves the pen around the paper.

Rollerbeds require precise coordination

of two discrete and fundamentally different systems: one for the pen and one for the paper. This added complexity can translate into higher costs. The most expensive plotters in this review, the Bruning Zeta 912 and Hewlett-Packard 7550A, are rollerbed machines.

But when price is enough of a concern to overrule refinements in resolution, rollerbed plotters, too, can sacrifice millimeters of precision for affordability. The least expensive plotters examined here (Enter Computer's Sweet-P 600 and the Hitachi 672-XD) are also of the roller-bed design. These machines demonstrated some failings in precision and accuracy during the PC Labs testing.

Rollerbed plotters have an inherent speed advantage. Paper is simply less mas-

WHAT DESKTOP PLOTTERS ARE UP AGAINST

by Winn L. Rosch

Putting pen to paper in these days when words, music, and money flash electronically through wires at the speed of light, seems about as anachronistic as stoking the furnace or paying cash. Other technologies are quicker and more colorful, yet plotters persist for several reasons.

When it comes to fast graphics output, laser printers—both single and full-size color—are without peer. A typical full-size graphics page might pour out in less than a minute, while a plotter struggles 5 or 10 minutes on the same chore.

With the advent of the Hewlett-Packard LaserJet IIP—list priced at \$1,495 but often discounted below \$1,000—plotter and monochrome laser printer capital costs are comparable. (Investing in a full-color laser is a more costly proposition. For example, the first "low-priced" color laser, the QMS ColorScript 100, lists for \$9,995, and the five color page printers reviewed in *PC Magazine's* last printer round up (November 14, 1989) had an average list price of about \$11,145. Most of the affordable lasers are limited not only to one color—usually black—but also to media no larger than ANSI size A (8.5 by 11 inches).

Plotters deftly draw in any color that you can find in a pen and will blend color in nearly unlimited combinations (as long as you're willing to manually

change pens at the appropriate times). And even the most compact of desktop plotters (with the exception of Hewlett-Packard's ColorPro) handles sheets up to B size (11 by 17 inches). Additionally, they are almost indifferent to the medium upon which they plot. Just match the proper pens, and plotters will happily ink paper, vellum, mylar, or whatever you lay on their beds.

The comparison to color ink jet printers is nearly the same. Inexpensive ink jets won't handle large sheets. Those that will accept B-size paper cost more than a comparable plotter. However, ink jets can stretch their color spectra through dithering and mixing inks on paper. They can even add a more natural look by shading from one hue to another, although not under direct manual control.

PLOTTER WINS AND LOSSES

Plotters beat nearly all printers when it comes to accuracy: most move in steps of about 0.001 inch—more than three times finer than the 300 dots per inch delivered by the typical laser engines. (Ink jet printers have even lower resolutions than lasers; for example, the Hewlett-Packard PaintJet (\$1,395) delivers only 180 dpi; the Tektronix 4696 (\$1,795) is capable of only 120 dpi.) The plotter's resolution is put to good use drawing curves from which every trace of jaggedness has been expunged.

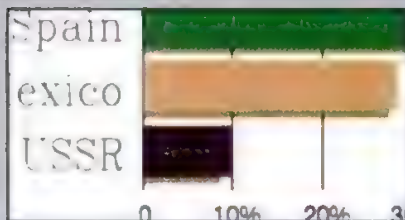
But lasers lead when it comes to fine

HARDWARE

DESKTOP PLOTTERS

sive than overreaching mechanical arms and pen carriages, and Newton's Second Law (for those needing a refresher course in freshman physics: $F = ma$, force equals mass times acceleration) says that it's less work to speed up a lighter object. Little wonder that the overall winner in both speed and quality was Hewlett-Packard's aforementioned rollerbed 7550A.

But while they may be fast, most drum plotters constrain your choice of widths in the drafting medium: they will grip it only at its edges and, for design reasons, the paper grippers are a fixed distance apart. Narrower widths of drafting media simply cannot be properly gripped. Only Fujitsu breaks this mold by using a full-width drum that will grasp any width of paper down to postcard size.



Hewlett-Packard 7550A plotter output

detail. Although plotters can draw almost absolutely smooth diagonals thanks to their high resolution, the finest details they can create are limited to the widths of the lines drawn by their pens. Typically, the finest plotting pen available inks a line three-tenths of a millimeter wide—about 12 times the width of the plotter's resolution or step size, and about 4 times wider than the thinnest laser line.

On the other hand, plotters can draw in solid colors rather than the spotty digital dots fused to paper by the lasers or sprayed by the ink jets (not to mention the pointillism of impact dot matrix engines). Plotter colors are pure and consistently toned.

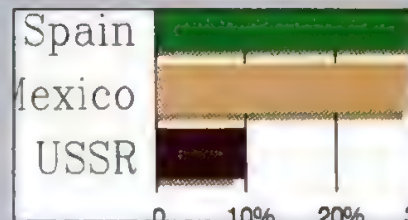
SPEED ISSUES

Direct speed comparisons between printers and plotters are impossible because they use different imaging techniques. Printers are raster-based devices; plotters draw vectors. As a result, the question of which is faster depends on what you want to draw.

With a flatbed plotter, you don't face minimum size limits. Flatbed plotters let you use virtually any size of drafting medium up to their physical limits. After all, flatbeds are just drafting tables with automated arms attached. Anything that the table will hold can be drawn upon—with the proper software instructions, of course.

As with drafting tables, flatbed plotters require some means of securing paper to the drawing surface. Ordinary drafting tape will suffice, but it's hardly an elegant solution. Plotter makers have adopted several strategies to eliminate the pesky stickiness of tape.

Roland in its DXY-1300 and American Graphtec in its MP4300-51 use the magic



Tektronix Phaser CP PostScript page printer output

Plotters may finish simple drawings first, but they will lag when images become more complex than a few lines. Dot-addressable printers like lasers or impact dot matrix machines (as opposed to those that use a language like PostScript) will devote about the same amount of time to complex drawings as they do to the simplest ones: they have to scan an entire sheet no matter how many lines are to be drawn. (PostScript printers will take somewhat longer for more-complex drawings because of the transfer and processing times that must be added in.)

The bottom line: affordable laser printers are faster but lack color capabilities and the 0.001-inch resolution of plotters. Color page printers are quick, costly, and not quite as sharp. Color ink jets offer multiple hues, moderate speed, and costs comparable to plotters but lack the ability to create smooth, detailed drawings. Plotters, though slow, are moderately priced, colorful, and accurate. For many applications, plotters still deliver the right combination. ■

of static electricity to hold the drafting medium down, a sticking strategy that works for all but a few media. Houston Instrument uses magnets instead of electricity, a tactic that should work with any medium except thin sheets of iron.

TAKING STEPS

The most important difference between low-cost and expensive plotters is precision. A better plotter has a smaller resolution, or step size.

Step size, limited chiefly by a plotter's mechanical resolution, is defined in terms of the finest movements the hardware can make, given the inevitable coarseness of the stepper motors that move the pens. For example, inexpensive plotters like the Enter Computer Sweet-P 600 can draw steps no finer than .004 of an inch because of mechanical constraints. On the other hand, the drawing quality of plotters capable of greater precision may be limited by the addressability of the language used to communicate with them. Although the Hewlett-Packard 7550A has a mechanical resolution of .00025 of an inch, it's limited to a .001-inch step size because of the coarser addressability of HPGL.

The smaller the step size, the smoother the curves a plotter can draw. Each step shows as a right-angle bump in a diagonal or curved line. At the .001-inch limit of HPGL, steps are less than a third the size of a laser-printer dot—so fine that they are essentially invisible.

COLORFUL OUTPUT

Desktop plotters differ in the number of pens that they can select from automatically. Although there's a rough correspondence between color capabilities and the number of pens that a plotter can handle, you can make multicolored plots with even a one-pen engine. Most plotters allow you to pause their work and exchange pens, giving you manual control over the hues of their output. So a four-pen plotter, for instance, can ink drawings in as many tints as are available in compatible pens.

Plotters offer you a choice of pen types to load. Which you use depends on the type of output you want; for example, paper and film plots require different kinds of ink, perhaps different pen types. Some manufacturers offer refillable pens. These offer you the higher quality (thinner, more consistent lines) of a drafting pen without making you go to the expense of buying a new one when the ink runs out. Actually, the closest to a standard among plotter

HARDWARE

DESKTOP PLOTTERS

is the design that is used by Hewlett-Packard machines and followed by several manufacturers.

When deciding on a plotter, opting for the one that offers the widest selection of pen types and inks will give you the most versatility in your plotting work.

PLUGGING IN

With plotters, compatibility is a major issue. Traditionally, plotter makers have viewed their products as professional tools: at minimum, you needed to have a special cable manufactured for your particular installation. Most of that frustration lies in the past, however. The typical plotter now includes a Centronics-style parallel port that makes it as easy to connect as a dot matrix printer.

Several machines still depend on RS-232 serial connections. Others make it an option. (All plotters reviewed here were tested using 9,600-bit-per-second serial transmissions so that their actual performance could be isolated from communications concerns.) If you choose to use a serial link, you'll probably want to buy the plotter maker's own serial cable because it has been designed to match the needs of that particular device.

Unless you already have other peripherals that use it, you probably won't want to tangle with the cost, intricacies, and special software drivers required to use the IEEE-488 connection (also known as GPIB, the General Purpose Interface Bus, or HP-IB, the Hewlett-Packard Interface Bus) that some plotters make available.

HPGL isn't the only plotter language you can use. In a few cases you'll find a program that supports your plotter's own native tongue. Using a plotter's proprietary language may reward you with extra speed. For example, Enter Computer's Sweet-P 600 plotted about 20 percent faster using its native language in place of HPGL (under *Harvard Graphics*, however, using SP-GL brought no increase in speed).

SPEED PLOTTING

As with printers, most plotters have built-in RAM to buffer plotting instructions. A large buffer (like the 1MB in the Roland DXY-1300) allows the plotter to absorb most or all of the instructions sent out of your PC and process them while your computer does something else.

Some plotters take further advantage of their buffers by looking ahead at plotting instructions and calculating how to mini-

mize pen movement or pen changes—for example, drawing all black lines before switching to the red pen. Such optimization can substantially trim the time required for making plots.

When PC Labs put these ten desktop plotters to work, the speed differences proved most dramatic: some machines finished plots in half the time of others. Outside the least expensive plotters, drawings output by the plotters were well matched. However, text renderings (such as annotations) varied with each plotter's interpretation of HPGL.

While all that is good news, the best is that plotters still give the best graphics hard copy that's both colorful and affordable. Standardization and more attention to the needs of the PC marketplace mean that they're now easier to set up and use than ever before. Perhaps those are small steps for ten years' progress, but small steps are what plotters specialize in.

AMERICAN GRAPHTEC INC. American Graphtec MP4300-51 All reviews by Winn L. Rosch

The high drawing speed—25.2 inches per second—promised by the big, flatbed American Graphtec MP4300-51 may not seem to be on the level, but that's okay because this B-size plotter doesn't have to be. Its maker includes two triangular plas-



The \$1,895 MP4300-51 from American Graphtec has good speed, quality output, and a full eight-pen palette. The electrostatic drawing surface keeps any type of paper securely in place.

tic braces to put the 5- by 23.5- by 17.5-inch (HWD) machine on edge, leaning back at a 60-degree angle. Instead of looking down at your plots as they materialize on paper, you can watch them take shape billboard-style.

On edge, the \$1,895 MP4300 is a breeze to load with any likely drafting medium: it accommodates coated, tracing, and measurement paper, as well as polyester and transparent films. Just slide a sheet in place under the y-bar that holds the pen carriage, press a button to activate the electrostatic platen, and most media stick securely down.

Some overhead projection films and multiple sheets of paper won't stick and will require drafting tape to keep them in place. In actual use, the lack of an indicator made it difficult to determine whether the electrostatic charge was on or off until the edges of the paper curled up.

The only problem with loading medium onto the MP4300 is the lack of a way to align it more than once. The plotter bears no marks, stops, or indications for guidance at all. In fact, the instructions merely say to put the paper about a half-inch from the edge of the electrostatic surface.

Not only does the MP4300 accommodate any size medium up to ANSI B, but it also features an expanded drawing mode that stretches the normal limits of its plots from 10.5 by 16.4 inches to 11.7 by 17 inches.

PENS AND PLOTTING

To keep shifting among colors to a minimum, the MP4300 accommodates eight pens and can optimize pen swapping within the limits imposed by its 40K nonexpandable internal buffer. This optimization was one reason that the MP4300 proved to be the fastest of the flatbed plotters tested.

The pens line up on the left margin of the drawing area, capped in rubber cups and held in place by magnets. Graphtec supplies supplementary plugs for the capping cups to prevent ink pens (as opposed to fiber-tipped) from drying out, as well as tweezers to put the plugs into place. To mate with the magnets, the Graphtec pens wear steel cummerbunds, a proprietary design that may limit your sources of supply.

The rated maximum drawing speed of 25.2 inches per second is achieved by a servo-controlled direct-current motor system. Maximum speed is acceptable only for drawing with fiber-tipped pens using water-based ink. More accurate drawings with ceramic pens, oil-ink fiber tips, and

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HARDWARE

DESKTOP PLOTTERS

disposable ink pens require slower drawing speeds (as low as 4 inches per second for ceramic-tipped pens).

Drawing speed and a wealth of other parameters can be selected through software or using a membrane-switch control panel at the upper edge of the MP4300. Controls also allow you to manually select pens; move, raise, and lower them; scale plots or mirror-image-invert them; set the plot origin, and pause plotting.

These user controls supplement two banks of DIP switches hidden behind a removable plastic door on the bottom of the MP4300. Besides determining the communications port and parameters used by the plotter, these switches also set default values for pen speed, drawing size, step size (0.001 or 0.00025 inch), and the language understood by the machine. The mechanical resolution of the MP4300 is even finer than the best of these choices: 0.0002 inch.

For power, the 14.5-pound MP4300 requires an external transformer in a white plastic case that's located midway in the power cable. According to the factory, making a serial connection with a host PC requires a special \$50 interface cable, although the proper pin-out to enable you to make this cable is shown in the MP4000-series user manual. A reference manual for the command language is also included with the system. (A version of the MP4300, suffixed -11, is available with a IEEE-488 interface but must be specially ordered from Japan, where the MP4300 units are made.)

The powerful motor in the MP4300 makes itself known, whining noticeably during plots, but it's often out-shouted by the clatter of raising and lowering the pen, which can occur as often as 15 times a second. Keep the MP4300 away from your telephone and away from where you regularly work if you want to preserve your hearing and sanity.



FACT FILE

American Graphtec MP4300-51

American Graphtec Inc., 17942 Cowan, Irvine, CA 92714; (800) OK4-PLOT; (714) 261-7568.
List Price: \$1,895.

In Short: An eight-pen flatbed plotter with electrostatic media holding that handles paper and transparencies up to ANSI B size. It delivers moderate speed and compatibility with both HPGL and international standards.

CIRCLE 414 ON READER SERVICE CARD

Besides the HPGL used for testing, the MP4300 understands Graphtec's own language, GP-GL; Graphtec claims GP-GL is as much an international standard as HPGL is an American one. While the MP4300 did a good job drawing under HPGL, the text characters proved to be slightly larger in size than those of a true HP plotter.

The FCC Class B-certified MP4300 carries a one-year warranty. Choose it if you want the fastest flatbed at a decent price.

BRUNING COMPUTER GRAPHICS

Zeta 912

Say you want to draw the plans for the entire 3 miles of the Stanford Linear Collider on one big sheet, or perhaps you'd like to render a pair of recumbent anacondas life-size. For tasks like these, the plotter of choice is the Zeta 912 from Bruning Computer Graphics (a division of AM International). This machine will take you from A-size plots up to those a tenth-inch over 2 feet in width by 120 feet in length.

Besides size, the Zeta 912 delivers speed, clocking in with the quickest presentation graphics plot of any machine in this roundup—nearly 20 percent faster than its closest rival, the Hewlett-Packard 7550A. It was also a match for the HP machine in CADD plotting.

But the dual virtues of drawing fast and vast extract a price—and I don't just mean the \$3,950 for the Zeta 912 and its start-up kit (which includes media, pens, and a SmartCable to lighten the frustration of making a serial connection). You'll have to forego some handy features: the machine doesn't automatically cap its pens, and it can't digitize. Additionally, it requires a special diet of proprietary pin-feed paper.

That said, you'll find the Zeta 912 to be a heavy-duty drum plotter with a wide range of capabilities and emulations even if you keep your plots within the confines of a B-size sheet. A hunkering metal desktop prism, measuring a stout 9.75 by 23 by 12 inches (HWD), the Zeta 912 can spin through rolls or fanfold media at up to 30 inches per second with a step size of 0.001 inch and an exemplary accuracy of 0.1 percent.



FACT FILE

Zeta 912

Bruning Computer Graphics, 777 Arnold Dr., Martinez, CA 94553; (415) 372-7568.

List Price: \$3,950 (includes startup kit).

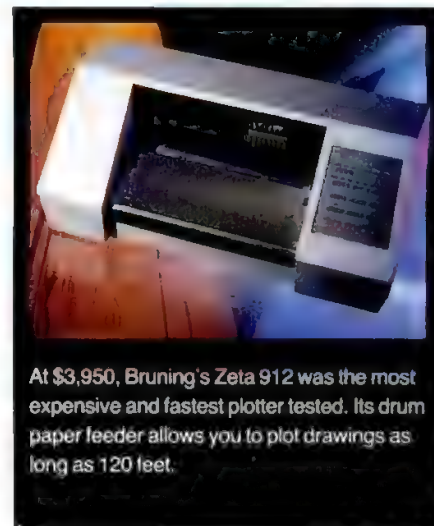
In Short: An expensive high-speed rollerbed plotter that handles continuous pin-feed media up to 11 inches wide by 120 feet long with eight pens and a wide variety of emulations.

CIRCLE 415 ON READER SERVICE CARD

As with all drum plotters, the drafting medium used by the Zeta 912 moves longitudinally while the pens travel laterally across the sheet on a small carriage. Registration is maintained using the tried-and-true drum-feed system with sprocket holes in the edges of the medium. The proprietary Bruning drafting medium uses elongated holes on the left and circular feed holes on the right.

Paper is loaded by sliding it from the rear over the drum and down the front apron of the plotter. It's held in place by two thin and unmovable wire arms. Two metal hubs are supplied for the roll paper, which drops neatly in place behind the Zeta 912.

The Zeta 912 has a full repertory of eight hues, automatically selected using a clever carriage mechanism that resembles



At \$3,950, Bruning's Zeta 912 was the most expensive and fastest plotter tested. Its drum paper feeder allows you to plot drawings as long as 120 feet.

a calliope of colored pens. Special narrow-diameter pens (available in felt-tip, liquid ink, and roller-ball designs) slide into a carrier called a pen block. A solenoid-controlled arm snaps the selected pen down against the fat rubber drum to make drawings.

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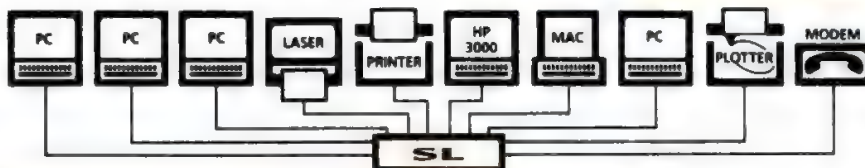
PC Magazine [July 1989, Page 263]:

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HARDWARE

DESKTOP PLOTTERS

Besides the plotter's native mode, which uses Bruning's proprietary Graphics Machine Language (GML), the Zeta 912 emulates HPGL plotters (specifically the HP 7585A or 7475A), Tektronix plotters, the Calcomp 960, and IBM 7375 and 7372 plotters. Three fonts are built into the Zeta 912 (fixed and proportional Roman and proportional Outline Swiss), but not all three are supported under each emulation.

The Zeta 912 comes standard with an RS-232 input; IEEE-488 is a factory-installed option that adds \$500 to the price.

For \$1,000 extra, you can also choose an IBM 3270 interconnect option.

SETUP CONTROLS

A door magnetically secured to the left side of the Zeta 912 hides the mechanical setup controls of the plotter. (The magnets are built into the plotter so that you won't have to worry about putting the removable door atop a stack of floppies.) Three DIP-switch banks select emulations, communication parameters, operating modes, and

resolution. Two thumbwheels control pen type and media.

A control panel on the right side gives you authority over the day-to-day operation of the plotter using Bruning's Parameter Mode Select system. By pressing combinations of push buttons, you can take direct command over paper and pen movement; pen selection; plot size, scaling, and orientation; and diagnostics. When a different pen or media type is selected, the Zeta 912 will automatically adjust its drawing speed and pen pressure to match the new specifications.



DESKTOP PLOTTERS: SUMMARY OF FEATURES

Products listed in ascending price order

	Enter Computer Inc. Sweet-P 600	Hitachi America Ltd. 672-XD	Fujitsu Component of America FPG-315	Hewlett-Packard Co. ColorPro	Houston Instrument HI Image Maker	American Graphtec Inc. MP4300-51
List price	\$795	\$895	\$1,295	\$1,295	\$1,295	\$1,895
SPECIFICATIONS						
Dimensions (HWD, in inches)	3.4 x 18 x 11.5	5.3 x 18.7 x 8.6	3.8 x 16.8 x 10.4	4.9 x 18.1 x 12.1	5 x 23.8 x 17.8	5 x 23.5 x 17.5
Weight (lbs.)	8	13.5	9.9	12	15	15.4
Maximum paper size	B	B	11 x 32 inches	A	B	B
Paper movement	Rollerbed	Rollerbed	Rollerbed	Rollerbed	Flatbed	Flatbed
Paper hold system	Grit wheel	Pinch roller	Pinch roller	Grit wheel	Magnetic	Electrostatic
Automatic paper feed (capacity)	☐	☐	☐	☐	☐	☐
Number of pens	6	4	6	8	8	8
Pens automatically capped	☒	☐	☒	☒	☒	☒
Claimed maximum pen speed (inches per second)	14	11	10	15.7	15.7	25
Adjustable pen speed	☒	☐	☐	☒	☒	☒
Step size (inches)	0.004	0.001	0.001	0.001	0.001	0.0002
Claimed accuracy	Unspecified	0.4%	0.5%	Unspecified	0.3%	0.3%
INTERFACES						
Serial	☒	☒	☒	☒	☒	☒
Parallel	☒	☒	☒	☐	☒	☒
IEEE	☐	☐	☐ (available on FPG-201, \$1,295)	☒	☐	Optional (\$300)
PROGRAMMING						
HPGL-compatible	☒	☒	☒	☒	☒	☒
Proprietary language	SP-GL	None	None	None	None	GPGL
OTHER FEATURES						
Buffer size						
Amount installed	1.5K	512 bytes	12K	60K	5K	40K
Minimum installable	1.5K	512 bytes	1K	60K	5K	40K
Maximum installable	7.5K	512 bytes	12K	1MB	5K	40K
Acts as digitizer	☐	☒	☒	☒	☒	☒
Warranty	90 days	1 year	1 year	1 year	1 year	1 year
FCC class certification	B	B	B	B	B	B

—Editor's Choice ☒—Yes ☐—No

HARDWARE

DESKTOP PLOTTERS

Setup and normal operation of the Zeta 912 machine are thankfully straightforward, and, as is not the case with most of the other plotters, you can plug pens into the pen block quickly and without messing up your fingers.

You'll probably need to become familiar with the controls as soon as you switch the Zeta 912 on. As it came from the factory, the HPGL instruction of the test plots sent its pens scurrying across the perforations at a frightening speed onto the sprocket feed area of the medium. Otherwise output quality from the Zeta 912 is

exactly what you'd expect; you get smooth curves with precise matching of joined lines. As with several other supposedly HP-compatible plotters, text output proved oversized.

The American-made Zeta 912 is protected by a 90-day warranty that promises on-site service. Consider this FCC Class B-certified machine a special-purpose plotter—one that's at its best when plot speed and size are your most important considerations.

ENTER COMPUTER INC. Sweet-P 600

Unassuming is an apt description for Enter Computer's Sweet-P 600. It lacks both pretention and priciness. The \$795 American-made machine is the least expensive one reviewed here; nevertheless, it is capable of meeting the basic plotting needs of those for whom cost is the all-important consideration.

The little—3.5- by 18- by 11.5-inch (HWD)—8-pound drum plotter does deceptively good work on media up to B size (11 by 17 inches). It's easy to set up, thanks to standard serial and parallel interfaces, and easy to use, thanks to its understanding of both HPGL and its own SP-GL language.

The Sweet-P doesn't slight on pens, keeping six ready for work. The pens are accommodated in a carousel to the left of the active drawing area. The entire carousel lifts out of the plotter to make it easy to insert pens. The only flaw in the process is that the instructions do not outline the proper way to align the carousel when you drop it back into place. But after an error or two, the correct procedure quickly becomes obvious.

While the Sweet-P's 14-inch-per-second pen speed seems modest, the system can be 25 percent faster than flatbed plotters costing nearly twice as much. Choosing the Sweet-P's native operating mode, which was not used for benchmark testing, can further speed jobs along. SP-GL cut half a minute from the 3 minutes, 45 seconds required to plot the *AutoCAD* nozzle using HPGL. Under *Harvard Graphics*, however, SP-GL brought no speed benefits whatsoever.

The Sweet-P comes up short in features and precision. For instance, it lacks the ability to optimize pen movement and digitize; moreover, its paper handling is primitive. Loading the Sweet-P means pushing back a lever on its top, which lifts the pressure rollers from its grit-wheel drive system. Then you must slide a sheet of drafting medium into place while holding the arm back.

On the plus side, the Sweet-P easily handles big paper, accommodating both A- and B-size media by the simple expedient of holding the smaller sheets laterally and the larger sheets longitudinally.

In that the Sweet-P understands HPGL, it earns addressability of 0.001 inch. How-

Hewlett-Packard Co. 7475A	Roland Digital Group DXY-1300	Hewlett-Packard Co. 7550A	Bruning Computer Graphics Zeta 912
\$1,895	\$2,495	\$3,900	\$3,950
5 x 22.4 x 14.5	4.3 x 24 x 16.5	8.5 x 26 x 17	9.8 x 23 x 12
16	13	38	52
B	B	B	B
Rollerbed	Flatbed	Rollerbed	Rollerbed
Grit wheel	Electrostatic	Grit wheel	Pin feed
☐	☐	■ (150 pages)	■ (120 feet)
6	8	8	8
■	■	■	☐
15	16.5	31.5	30
■	■	■	■
0.001	0.0005	0.001	0.001
Unspecified	0.3%	Unspecified	0.1%
■	■	■	■
☐	■	☐	☐
■	☐	■	Optional (\$500)
■	■	■	■
None	RPGL	None	GML
1K	1MB	12K	18K
1K	1MB	12K	18K
1K	1MB	12K	18K
■	■	■	☐
1 year	90 days on parts, 1 year labor	1 year	90 days on-site
B	B	B	B

ever, its lack of precision means that it can mechanically resolve steps only four times larger. On paper this imprecision showed up as a slight coarseness to curves that was obscured by using wide-tip (0.7mm) fiber pens. It matches HP characters for size and does a reasonable job of keeping round characters round rather than angular.

LIGHTWEIGHT AND LOUD

Light weight and low cost do not necessarily equal flimsiness, but the Sweet-P definitely has that feel. The entire exterior of its case is constructed of thin plastic that doesn't instill much faith. However, the Sweet-P has garnered an FCC Class B certification.

While it's low on radio-frequency noise, the Sweet-P rates high on the audible scale. The machine-gun rattle of the Sweet-P 600 raising and lowering its pen was the only plotter clamor other people in PC Labs complained about.

The Sweet-P's controls are minimal: three push buttons and a power light. One button selects the self-test. Another pauses plots. A third selects the next pen on the carousel so that you can make plots more colorful than your software permits.

Setup of the Sweet-P is as simple as setting the single eight-bank DIP switch



The six-pen Sweet-P 600 from Enter Computer isn't quiet, and it doesn't have all the features of the more expensive plotters, but, at \$795, it offers good basic output for the lowest price.

that's accessible through a cutout on the rear panel of the plotter. You simply choose paper size, emulation, and serial port speed (if you decide to use the Sweet-P's RS-232 input). Other communications

HARDWARE DESKTOP PLOTTERS

PC FACT FILE

Sweet-P 600
Enter Computer Inc., 7710 Kenamar Ct., San Diego, CA 92121; (800) 356-2808; (619) 578-4070.
List Price: \$795.
In Short: A low-cost, noisy rollerbed plotter with B-size abilities. It has the lowest resolution of this group—0.004 inch—but offers good speed and a full eight-pen selection.

CIRCLE 416 ON READER SERVICE CARD

parameters are permanently set (8-bits, no parity, 1 start and 1 stop bit). Installation is easier still if you choose to use the parallel port: just plug it in.

The Sweet-P plotter uses an internal power supply, so you need only plug its permanently attached cord into an outlet. A companion model, the Sweet-P 601, operates from European-spec power and is designed to handle A3 and A4 (European) paper sizes.

To keep the cost of the Sweet-P low, Enter Computer cut a lot of corners. Its documentation is barely sufficient; its warranty, a brief 90 days. However, its modest 1.4K buffer expands to a less modest 7.5K with the simple addition of an \$18 chip. If your budget requires that you, too, cut as many corners as you can, the Sweet-P is your best choice.

FUJITSU COMPONENT OF AMERICA Fujitsu FPG-315

The FPG-315 from Fujitsu Component of America has set its aim on mirroring one of its best-known competitors: the Hewlett-Packard 7475A plotter (also reviewed here). As with the HP machine, the \$1,295 Fujitsu is a drum plotter with a six-pen capacity. Moreover, the Fujitsu is a rival in quality as well, duplicating the 0.001-inch accuracy of the HP original.

Fujitsu has done a very good job emulating the HP but seems reluctant to mention the name of its mentor: the documentation doesn't even note the FPG-315's compatibility with HPGL, despite the fact that this is the only language the plotter understands.

Text characters output from the FPG-315 match HP's own in size, shape, and

style. In drawing, the FPG-315 renders curves smoothly and precisely. The only drawback is its plodding, 10-inch-per-second pen speed that puts the FPG-315 among the slower drum plotters.

IN ITS OWN RIGHT

Regarded in its own right, the FPG-315 is a very nice plotter. It uses a grit-wheel paper-holding system but adds several improvements. The Fujitsu grit wheel runs the full 11-inch width of the drawing area. The small rubber pressure rollers that hold the drafting medium down by its edges are adjustable to handle odd paper sizes, even down to postcard size.

At the other extreme, the FPG-315 can grasp sheets up to the 11-inch width of its drive drum and will plot down a 32-inch length of 34-inch paper. In between, it easily handles both A- and B-size paper.

Paper feeding and alignment is simple. Just slide a sheet into the FPG-315's mechanism, press a push button (Paper Set), and the plotter takes over, generally with perfect results. Several times during testing, however, the FPG-315 managed to shift the drafting medium to an odd angle while loading it. Fujitsu supplies a wire frame for holding input and output paper stacks, but no automatic feed mechanism is available.

The 3.75- by 16.75- by 10.5-inch (HWD) machine resembles a pair of conjoined wedges. The six pens from which the FPG-315 selects are loaded into a removable carousel that ordinarily hides underneath a cover on the left side of the drawing area. Slide the cover off the left side, and both the carousel and the two banks of eight setup DIP switches are easily accessible.

The carousel is notable for its economical mechanical connection with the paper drive motor. As the FPG-315 rolls paper over its drive roller, it also spins the carousel; as it spins the carousel to select a pen, the paper shoots in and out of the plotter.

PC FACT FILE

Fujitsu FPG-315
Fujitsu Component of America, 3330 Scott Blvd., Santa Clara, CA 95054; (408) 562-1000.
List Price: \$1,295.
In Short: An unabashed clone of Hewlett-Packard's six-pen rollerbed 7475A plotter that matches the original for speed and quality but costs about one-third less and handles media up to 34 inches long.

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HARDWARE

DESKTOP PLOTTERS



With its adjustable paper rollers, Fujitsu's \$1,295 FPG-315 can handle paper as small as a postcard or as large as 32 by 34 inches. The six-pen drawing speed is a little slow, but its quality makes it a worthy alternative to more expensive plotters.

The pen carriage travels across the width of the drawing area on two steel rails. The entirety of the mechanism is protected by a hinged transparent cover. This cover helps tone down the noise that the FPG-315 generates as it lifts and lowers its pen up to 20 times per second.

The DIP switches are used for the typical setup functions: setting the parameters of the standard serial connection, selecting default paper size and orientation in addition to enabling/disabling paper sensing, and selecting either 1K or 12K of RAM to use as an internal buffer. (Why would you want to use 1K when 12K is available? So that the FPG-315 will act *exactly* like a Hewlett-Packard plotter, of course.) In addition to the serial port, a parallel port comes as standard equipment. A GPIB-interfaced version of the FPG-315 is a factory option.

A small panel on the right side of the FPG-315 gives you manual control over pen and paper movement and selection. In addition, it adds a "View" mode that shoots the paper out the front of the plotter (while keeping it in alignment) so that you can check the progress of plots.

With the exception of not mentioning the FPG-315's use of HPGL, the Fujitsu documentation is reasonably good. It documents most HPGL functions, the proper wiring of serial cables, and normal instal-

lation and operation. However, it lacks an index.

Fujitsu awards the FPG-315 a one-year warranty; the FCC gives it Class B certification. Overall, it ranks as a worthy alternative to the Hewlett-Packard lineup, its principal advantages being a larger potential plot size and a more modest price.

HEWLETT-PACKARD CO.

Hewlett-Packard ColorPro

While being the bottom member of a product line might seem to have negative implications, this is not the case with Hewlett-Packard's ColorPro (also known as the 7440A). This \$1,295 system can do nearly anything that other HP plotters can, at least when it's suitably equipped.

An eight-pen rollerbed plotter, the ColorPro uses the same grit-wheel drive system as do other HP machines. It also bears a strong family resemblance in the squared-off styling of its 4.9- by 18.1- by 12.1-inch (HWD) case.

Like other HP plotters, the ColorPro has a hinged smoked-plastic cover over its pen area to keep down the din. It differs from larger HP plotters in that its power supply is relegated to an outboard brick mounted midway in the power cable. And unlike HP's 7475A and 7550A (reviewed here), the ColorPro is limited by the fact that it handles only one size of paper, ANSI size A, and consequently yields a maximum plot size of only 7.5 by 10.2 inches.

USING THE COLORPRO

On the left side of the pen chamber is a hole into which you drop the ColorPro's removable carousel for fiber-tipped pens,

the only pen type that the plotter can use. Underneath the cover, which is part of the carousel itself, you'll find auto-capping stalls for eight pens. The carousel spins synchronously with the in-and-out dash of the drafting medium during plots because HP uses one motor for both jobs.

At the right side of the plotting area is the ColorPro's command center, plus an array of a dozen buttons that gives you manual control of pen functions and lets you reorient and reposition plots. In addition, a "View" button spins drafts in progress forward for your inspection without letting the ColorPro lose its place.

Despite being a low-cost plotter, the ColorPro automates paper loading. You simply slide a sheet of drafting medium until its front edge touches a white line on



At \$1,295, the ColorPro is the bottom-of-the-line plotter from Hewlett-Packard. It can handle only A-size plots, but it produces quality output and has a full eight-pen carriage.

the ColorPro's platen, then press the plotter's "Load" button. The ColorPro automatically lowers its pressure rollers against its grit wheels, grabs the paper or transparency, and spins it once in-and-out across the platen. In the process, it lays tiny tracks on the medium's edge to lock it in sync with the spin of the grit wheels.

The ColorPro does not optimize either pen motion or pen selection. In fact, those operations are nearly impossible with the ColorPro's standard internal buffer of just 60 bytes. However, the ColorPro accepts an expansion ROM cartridge that clasps onto the bottom of the machine like a small, rectangular electrical leech and extends the ColorPro's understanding to full HPGL support (the plotter by itself understands only a subset of HPGL) and expands the internal buffer to 1K.

As with other HP plotters, the ColorPro

FACT FILE



Hewlett-Packard ColorPro
Hewlett-Packard Co., 19310 Pruneridge Ave.,
Cupertino, CA 95014; (800) 752-0900.
List Price: \$1,295.

In Short: The bottom of Hewlett-Packard's desktop plotter lineup, a rollerbed machine that handles eight pens but is limited to A-size media.

CIRCLE 418 ON READER SERVICE CARD

HARDWARE

DESKTOP PLOTTERS

offers a step size of 0.001 inch. Its drawing speed is 15.7 inches per second, although it can be set to lower values through software.

The ColorPro is available with either of two standard interfaces, which you select at time of ordering: RS-232 or IEEE-488. The instruction manual contains an extensive section on setting up the ColorPro with a variety of computers, including wiring diagrams for the interconnecting cables.

The American-made ColorPro is FCC Class B certified and carries a one-year warranty. It's your first choice if you insist on genuine HP compatibility at a minimal price and don't mind its single paper size.

HEWLETT-PACKARD CO. Hewlett-Packard 7475A

Possibly the most sincerely flattered desktop plotter around, the Hewlett-Packard 7475A is definitely the most imitated. Every multipen plotter in this review claims some degree of compatibility with the standard set by the 7475A. And there's good reason for it: the \$1,895 machine



The 7475A, \$1,895 from Hewlett-Packard, is the most widely emulated plotter on the market today. Its fast, high-quality output suffers only from the machine's six-pen limit.

plots quickly, producing quality that other manufacturers find hard to match.

As with other HP models, the 7475A defines the rollerbed design. Paper or film drafting media are held at the edges by a grit-wheel and pinch-roller combination and whisked in along one axis while a pen carriage, guided by a shiny steel tube and powered by a cogged belt, slides perpen-

dicularly across. The mechanism inks paper at up to 15 inches per second (20 when the pen is raised from the paper), but it can be slowed through software to match the needs of pen and media.

The pen travels far enough to cover an 11-inch width, allowing the 7475A to plot on both A- and B-size sheets by altering the edge alignment of the medium. (The maximum plotting area on ANSI B-size paper is 10.2 by 16.3 inches.)

At the left of the plotting area, a cylindrical hole holds a removable pen carousel. Unlike most, the 7475A's design accommodates only six pens; that's why when you use a 7475A driver with your favorite software and an eight-pen plotter, the program's output is likely to short-change the full spectrum of your plotter. The 7475A wields fiber-tipped and refillable ink pens, provided they are the standard short-bodied Hewlett-Packard design. Each pen type requires its own special carousel; one fiber-tipped pen carousel is included with the basic system.

Although the 7475A is microprocessor controlled, it does not optimize pen travel. Its internal RAM buffer is limited to 1K (the reason why HP-compatible plotters often have an option to limit their larger buffers to this size). The 7475A can also digitize coordinates from hard-copy images.

Loading paper is a quick, manual operation. Push back the release arm to the right of the plotting area, slide in the drafting medium (aligning its left edge with the left edge of the platen), then lower the pin-roller arm. The 7475A does not register its paper (marking it with its grit wheels so that it does not slip) until it receives the first pen-moving instruction from your computer as part of a plot. No automatic paper-feed mechanism is available for the 7475A.

The on-paper quality produced by the 7475A is excellent—as is, for obvious reasons, its HP compatibility. The 7475A understands only HPGL, and its mechanical resolution of 0.001 matches the addressability of HPGL.

CONTROLLING THE PLOTTER

The control panel for the 7475A is an array of 16 small buttons on a panel to the right of the plotting area. Besides offering manual control of pen movement and selection, these switches allow you to alter the size and orientation of your plots.



FACT FILE

Hewlett-Packard 7475A

Hewlett-Packard Co., 19310 Pruneridge Ave., Cupertino, CA 95014; (800) 752-0900.

List Price: \$1,895.

In Short: The current standard among desktop plotters, a six-pen rollerbed design that handles both A- and B-size media with good performance and 0.001-inch resolution.

CIRCLE 419 ON READER SERVICE CARD

To link with your system, the 7475A is available with either an RS-232 or IEEE-488 interface (you must specify which at the time of ordering). The 7475A connects directly to your AC line using a removable power cable.

The styling of the 5- by 22.5- by 14.5-inch (HWD) system follows the basically square HP motif, sporting a plastic cover over the plotting area and pen carousel to keep the clatter down. The design works well: the 7475A is nearly silent, hardly louder than the whisper of the paper whisking through the mechanism.

The 7475A is FCC Class B certified and carries a one-year warranty. Although the 7475A is comparatively expensive for its speed capabilities (after all, the Fujitsu FPG-316 duplicates its speed in real-world performance and costs \$600 less), it's well made and sets the standard for output quality. While the smaller ColorPro is a better choice if you require only more modest A-size plots, this is the plotter for the uncompromising individual who demands full B-size output.

HEWLETT-PACKARD CO. Hewlett-Packard 7550A

Think of Hewlett-Packard's 7550A as a magical black box into which you merely pour HPGL, and out come completed plots! The procedure is so elegant that you need hardly even think about it. The 7550A is among the fastest plotters reviewed here and, overall, the best. It's also expensive: \$3,900 for the basic plotter with two carousels, trays for A-size paper, media samplers, and assorted pens.

With its standard-equipment automatic paper-feeding mechanism, the 7550A earns the title, "prestidigitator of plotters." Stack up to 150 sheets of paper (or

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PC WEEK/REVIEWS SCOREBOARD

Attributes	Barclay Quattro 1.01	CA SuperCalc5	Lotus 1-2-3 2.2	Lotus 1-2-3 3.0	Microsoft Excel 2.0	PS VP Planner Plus 2.0
Data Integrity (1.06)	8	10	8	9	10	8
Ease of manipulating spreadsheet data (1.06)	7	9	8	10	8	8
Quality of documentation (1.00)	8	10	9	9	10	8
Performance relative to price (0.92)	10	7	7	6	7	9
Minimized RAM requirements (0.92)	9	10	10	5	6	10
Weighted Score	8.3	9.2	8.4	7.9	8.3	8.5

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The new IBM LaserPrinter, 1989.

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Paper-handling options	✓ 500 sheets, 75 envelopes	15 envelopes*
Collates letters/envelopes	✓ yes**	no
Plotter emulation	✓ standard	optional
Resident fonts	✓ 10	6
Font card size***	✓ credit card	"8-track" cassette
Standard weight	✓ 33 lbs.	50 lbs.
Parts***	✓ 400	1000
Dots per inch	300 x 300	300 x 300
Printer emulation	✓ IBM, HP compatible	HP compatible
Printer engine	IBM	Canon
List price	✓ \$2,595	\$2,695

*HP envelope tray replaces standard paper tray **With paper-handling options ***Approximate

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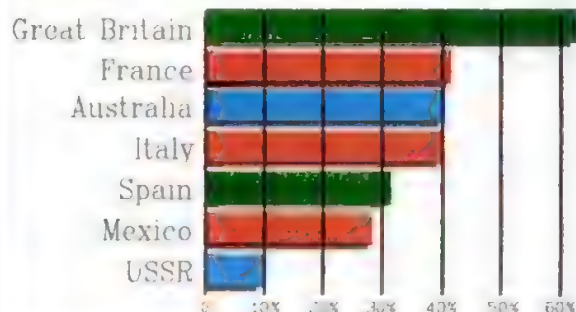
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PLOTTER OUTPUT SIDE BY SIDE

Below are samples of monochrome and multicolor output produced by the desktop plotters evaluated in this roundup. The monochrome image is the familiar *AutoCAD* nozzle drawing. The color image is a simple bar chart created in Micrografix's *Graph Plus*. As you look at these samples, look for smoothness in the diagonal and curved lines in the monochrome drawings and note the uniformity of color saturation in the color drawings. Remember, of course, that in a side-by-side comparison like this, the quality of the pens themselves is at issue as well.

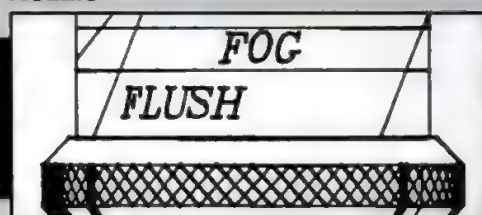
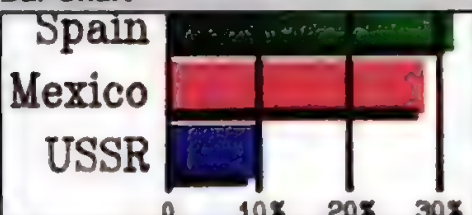
Which foreign countries would you most like to visit?



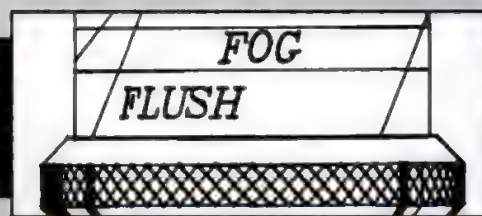
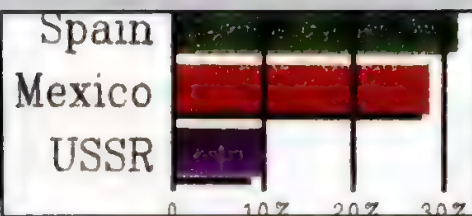
Bar Chart

Nozzle

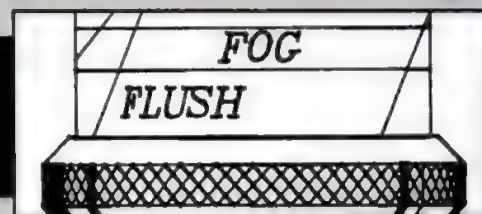
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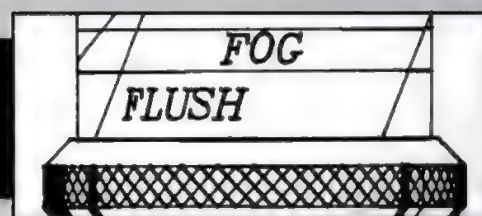
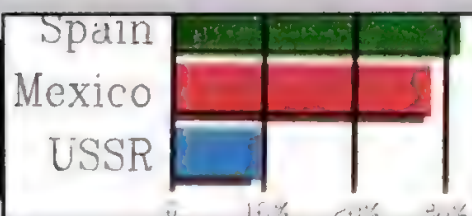
Zeta 912



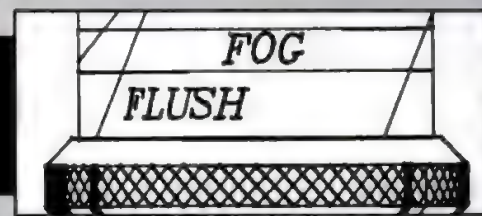
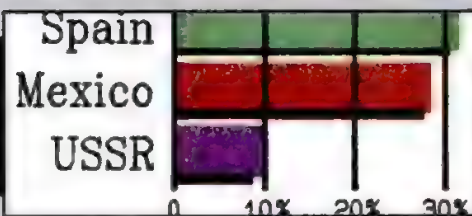
Sweet-P 600



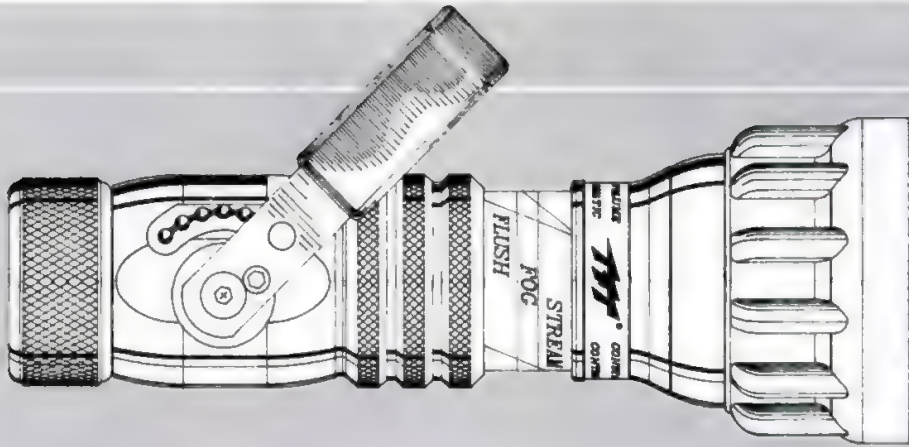
Fujitsu
FPG-315



Hewlett-Packard
ColorPro



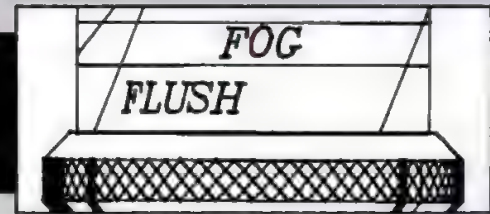
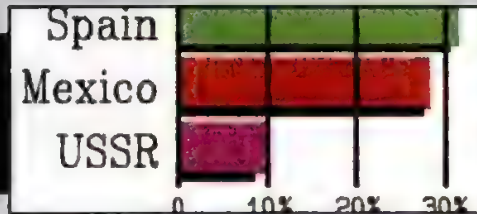
HARDWARE
DESKTOP PLOTTERS



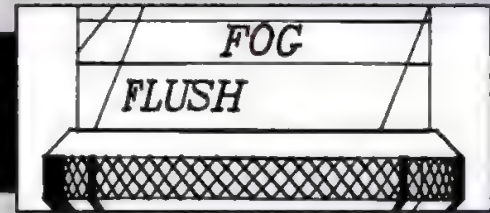
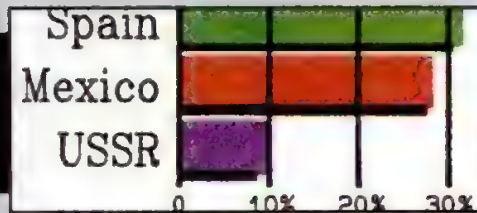
Bar Chart

Nozzle

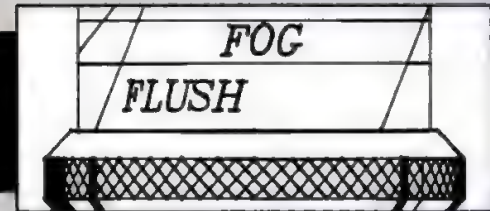
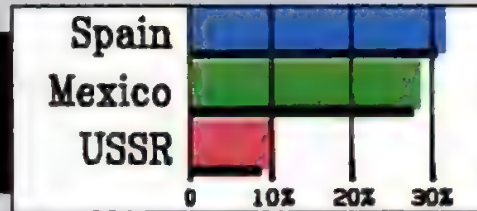
Hewlett-Packard
7475A



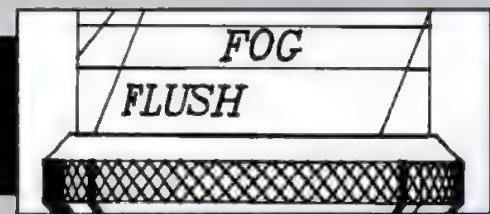
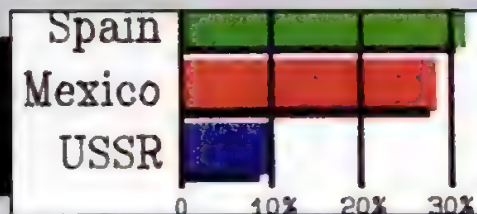
Hewlett-Packard
7550A



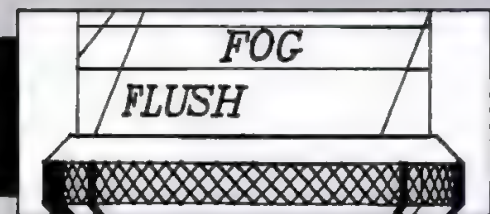
Hitachi
672-XD



Hi Image
Maker



Roland
DXY-1300



100 blank transparencies) in its front drawer, and it will plot through the entire stack without further attention.

In one brief in-and-out movement, the 7550A aligns each sheet precisely and spins it into the proper position for plotting. In a snap, it ejects each sheet with enough momentum to propel it halfway to Omaha. HP supplies a paper tray that attaches to the rear of the 7550A to intercept the flight of the sheets.

A CLASSIC CASE

The 7550A is a classic drum plotter (it was HP that patented the drum design) that uses grit wheels to hold each sheet of drafting medium in place. Because the wheels are fixed in spacing, the 7550A is set in the size of the media it can handle: A-size sheets feed in laterally; B-size sheets longitudinally. Maximum plot size measures 9.97 by 16.12 inches. (The self-contained automatic paper-feeding system ships as standard equipment, but it handles only A-size paper. Trays to handle European media sizes and 11- by 17-inch B-size sheets are options.)

This somewhat large machine—8.5 by 26 by 17 inches (HWD) overall—allows more than enough room for a fast, robust mechanism, one capable of moving its pen at up to 31.5 inches per second. Paper movements are equally brisk, with each sheet shuttle so fast as to become a nervous blur.

Quality is not compromised for the 7550A's speed. The 0.00025-inch mechanical resolution of the 7550A is hardly tapped by the 0.001-inch step size addressable by HPGL. Obviously, there are no compatibility problems with HPGL, and your plots come out just as sharp as they do with the other plotters from Hewlett-Packard.

The eight pens that the 7550A wields are held in a removable carousel that automatically caps those not in use. Hewlett-Packard offers different carousels for dif-

HARDWARE

DESKTOP PLOTTERS



At \$3,900, the Hewlett-Packard's 7550A is very expensive, but in this case you get what you pay for, including automatic paper feeding, an eight-pen carriage, superior output, and speed to burn.

ferent pen types (fiber-tipped pens for either paper or transparency); the carousels themselves carry coding that causes the 7550A to alter its plotting speed to match the different types of pens. Despite its 12K internal buffer, the 7550A does not optimize pen motion.

Two interfaces and three connectors are standard equipment on the 7550A. Two of the connectors are for RS-232 linkups: one connects to your PC, and the other extends the PC port to reach to another serial device. The other connector is for an IEEE-488 (GPIB) cable.

NO MORE DIP SWITCHES

Instead of DIP switches and jumpers, the 7550A features a completely menu-driven setup procedure using its small control panel and a 2-line by 20-character LCD display. Pressing control panel buttons sets the nonvolatile memory in the plotter for serial port parameters and other operating characteristics.

As simple as it might at first appear, the actual procedure is obscure, with some settings and values that you are unlikely to have encountered anywhere before. You may know enough to choose hardware handshaking but are left wondering whether or not the plotter requires a "direct" or a "remote" PC connection. The Hewlett-Packard manual helps sort through the choices by offering a single set of recommended PC settings.

The control panel is also used for normal plotter commands, including altering plot size, location, and orientation; digitizing; and manually selecting pens. Hewlett-Packard bestows a one-year warranty on

the Class B-certified machine.

The steep price is probably the only reason not to buy the 7550A. But considering its convenience, high-quality output, and fast plotting speed, the 7550A is more than a fair value. It's the best desktop plotter we've seen.

HITACHI AMERICA LTD.

Hitachi 672-XD

Frugal in design, frugal in price, the Hitachi 672-XD appears to be a bargain hunter's dream. And indeed, the \$895 machine does not compromise on output quality to keep its price low.

The model 672-XD is a modified drum plotter. The drum really consists of two short cylinders that are made from knurled brass. The one on the right measures about 2 inches long; the one on the left, about half an inch. The left drum mates with a pressure roller that remains fixed in a horizontal position. The pressure roller for the right drum adjusts over a range of about 1.5 inches to accommodate slight variations in paper widths within the nominal 11-inch limit of the mechanism. Both A- and B-size paper can be accommodated with a maximum plotting area that measures 10.6 by 15 inches.

Guided by a single steel tube, the pen carriage gains its impetus from a thin braided-steel cable that's wrapped around a brass capstan on the right side of the plotter. This mechanism produces a step size of 0.001 inch and an accuracy of 0.4 percent. Graphics plots appear smooth and without a trace of jaggedness, but text is drawn in angular fonts instead of smooth curves.

The carriage itself holds four pens in a collinear arrangement that's parallel to carriage travel. Pens are installed simply by dropping them into the appropriate holder, sort of like slipping cartridges into a revolver. Storage is located at the rear of the top rail of the plotter, where eight pens can be dropped into matching holes for safe-keeping.

Each pen chamber in the moving carriage has a flat spring at the bottom that keeps the pen from touching the paper. One small plastic finger shifts between the four pens on the carriage and presses down the appropriate one for plotting. (The finger can also get in the way when loading a pen chamber, but it can be pushed aside.)

**FACT FILE**
EDITOR'S CHOICE

Hewlett-Packard 7550A
Hewlett-Packard Co., 19310 Pruneridge Ave.,
Cupertino, CA 95014; (800) 752-0900.
List Price: \$3,900.
In Short: Simply the ultimate in desktop plotters,
with commanding features—a very fast rollerbed
with eight pens and automatic paper feeding for
A- and B-size media.

CIRCLE 420 ON READER SERVICE CARD

HARDWARE

DESKTOP PLOTTERS



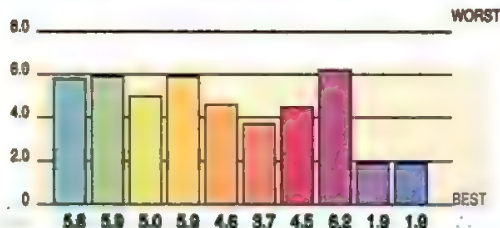
PERFORMANCE TESTS: DESKTOP PLOTTERS

Two of the most expensive desktop plotters that PC Labs tested, Bruning's Zeta 912 and the Hewlett-Packard 7550A, are also the two fastest.

Monochrome Image Plotter Speed

Elapsed Time (minutes)

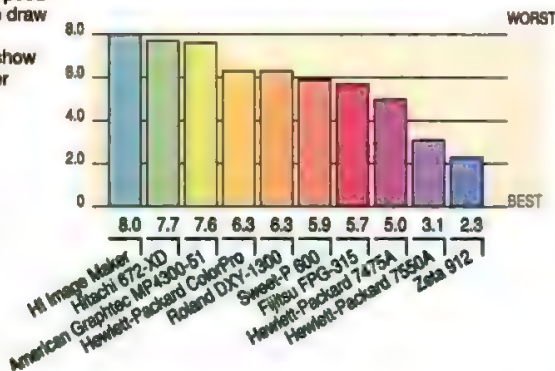
The **Monochrome Image Plotter Speed** test measures the time it takes to draw a monochrome image as standard A-size output. Results show the time in minutes that the plotter takes to complete the images.



Four-Color Image Plotter Speed

Elapsed Time (minutes)

The **Four-Color Image Plotter Speed** test measures the time it takes to draw a four-color pie chart image as standard A-size output. Results show the time in minutes that the plotter takes to complete the images.



HOW WE TESTED THE PLOTTERS

PC Labs testing of desktop plotters focused on the machines' abilities to produce both monochrome and color images. Our testing platform, the Compaq Deskpro 386/25, was enhanced with an 80387 math coprocessor and 4MB of expanded memory to take advantage of *AutoCAD*, Release 10, as well as of *Harvard Graphics*, both of which were run under DOS 3.31. To prevent *AutoCAD* drivers from unfairly speeding any individual plotter, the same HPGL driver was used for all ten plotters. Testing involved printing two representative images: one monochrome and one four-color.

The monochrome drawing was the familiar nozzle from *AutoCAD*; it's a good test of a plotter's ability to combine curved and straight lines. The four-color image was a simple pie chart created in *Harvard Graphics* that included several different text sizes.

Multicolor bar chart output samples were also created with Micrografix's *Graph Plus*. You can see the *Graph Plus* results in the accompanying sidebar of comparative output. The drawing of these bar charts was not timed.



DESKTOP PLOTTERS: COMPOSITE VIEW

The fastest plotter on the four-color pie chart test was Bruning's Zeta 912. PC Labs is familiar with speedy plotters from Bruning: the company's Zetadraf 900 edged out all other plotters during our tests for the issue of June 9, 1987. The Zeta 912 features the only pin-feed paper hold system in this group, an 18K buffer, and a claimed maximum pen speed of 30 inches per second. It was able to complete the four-color drawing in about 2 minutes and 20 seconds. Next-fastest on the pie chart test were two models from Hewlett-Packard: the 7475A and the 7550A. Given their fast claimed pen speeds (15 inches per second for the 7475A and 31.5 for the 7550A), these results are not surprising.

In monochrome output testing, Bruning's Zeta 912, the Hewlett-Packard 7550A, and Enter's Sweet-P 600 beat out their peers. The Sweet-P 600 offers a tiny step size (.004 inches) and has a claimed maximum pen speed of 14 inches per second.



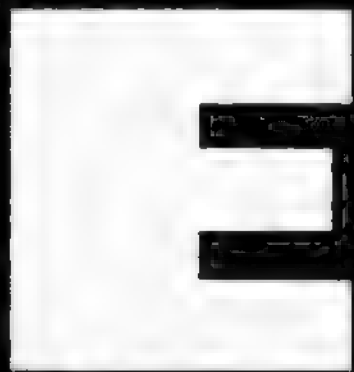
Relative Times
(Hewlett-Packard 7475A = 100)

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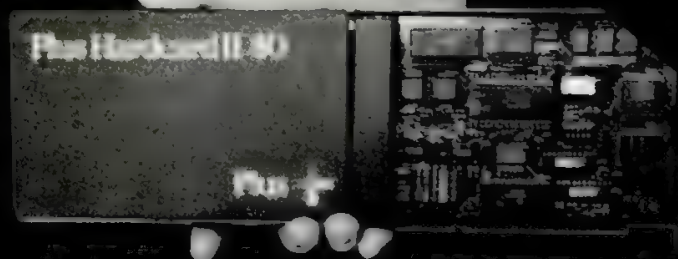
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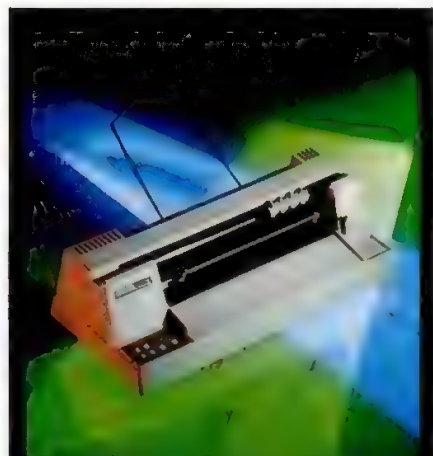


HARDWARE

DESKTOP PLOTTERS

PAYING FOR THE BARGAIN

Although the price of the unit is low, you will wind up paying for this system in terms of speed and convenience. The pen carriage travels at a modest 7.9 inches per second across the top of the drum mecha-



The Hitachi 672-XD produces quality plots for the low price of \$895. It's the only plotter tested here that has a four-pen carriage, but it's still a good deal for bargain hunters.

nism. This speed is constant and it cannot be altered no matter what type of pen is used.

The frugal design of the 672-XD becomes readily apparent whenever a new pen is selected. To change the position of the actuator arm, the whole carriage moves to one or the other side of its travel; this in turn nudges the actuator over one way or the other.

However, loading the 672-XD with drafting medium is painless. A lever, equivalent to a typewriter bail arm, releases the pressure rollers and raises stops behind the drum. You can then slide the drafting medium between the drum and pressure rollers until it runs into the stops. Releasing the bail-arm lever then causes the 672-XD to grasp the drafting medium. The only critical part of loading the mechanism is making sure that the left edge rests against the side of the plotter. Finished plots are spun out the back of the 672-XD. Hitachi supplies a simple bent-wire frame to catch them.

Once the 672-XD spins into action, you'll know it immediately without having to look. The mechanism sings as it works, exuding what might be interpreted as a Martian love song. The larger the paper that's loaded in, the louder its voice. When a heavyweight 11- by 17-inch sheet was

loaded, the 672-XD filled PC Labs with its extraterrestrial symphony. The rhythm section of the performance was provided by the rattle of the pens as they bounced up and down.

EASY SETUP

Both serial and parallel connectors are supplied for linking the 672-XD to your PC. Setup involves adjusting the two banks of DIP switches; the documentation is sufficient to help you through this step. In fact, the only lack is any mention of HPGL compatibility—a glaring omission considering that the 672-XD understands only HPGL. But Hitachi helpfully includes a booklet called "Summary Guide for Plotter Application Software" in order to help you match the 672-XD to your programs.

Overall, the 672-XD is economically made: the top of its case is crafted from an inexpensive but sturdy plastic and the bottom from stamped steel. Its power supply is built in and the power cord is detachable. The 13.5-pound machine meets FCC Class B criteria, so it won't interfere with any other appliances that you may have, and carries a one-year warranty.

Once the 672-XD
spins into action,
you'll know it
immediately without
having to look. The
mechanism sings as
it works, exuding
what might be
interpreted as a
Martian love song.

While the 672-XD will not win any speed records, it will do a good job of plotting on paper or on transparencies. It is an accurate and economical choice, though



FACT FILE

Hitachi 672-XD

Hitachi America Ltd., Office Automation Systems Division, 6 Pearl Ct., Allendale, NJ 07401; (201) 825-8000.

List Price: \$895.

In Short: An inexpensive but slow rollerbed plotter with modest four-pen abilities. Its B-size media capacity is a plus.

CIRCLE 421 ON READER SERVICE CARD

one that would benefit from a little bit more attention to detail.

HOUSTON INSTRUMENT HI Image Maker

From desktop plotters to floor-standing models, Houston Instrument makes plotters of all sizes to fit all budgets. Precision and price are the hallmarks of the HI Image Maker, and the focus is on keeping both numbers as small as possible. The Image Maker is designed to match the addressability of HPGL with a step size of 0.001 inch. And the system is available for a modest \$1,295.

A more economical implementation of a flatbed plotter would be hard to find. The Image Maker is built around two sheet steel pieces: one plated and formed into a bottom plate, the second fabricated into the bed of the mechanism. Plastic covers on the left and top of the plotting area hide the electronics and most of the mechanical parts.

A plastic channel serves as the track for the pen carriage. This arm, driven by a hidden cogged belt, moves the pen along the x-coordinate. The pen carriage, also powered by a cogged belt hidden in the channel, traverses the y-coordinate. The top of this channel is fitted to a rigid bracket that coasts along a track at the top of the plotting area. The bottom end is essentially free from any attachment and just rests on a low-friction tab.

The eight pen stalls that are lined up on the left side of the plotting area show an equally thrifty design. Each pen stall is a separate entity, molded from black nylon with a built-in pen cap, inexpensively made and inexpensive to replace should one break.



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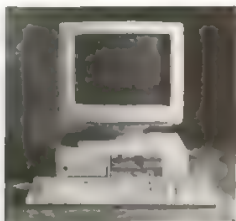
4. How many PCs do you have installed now?

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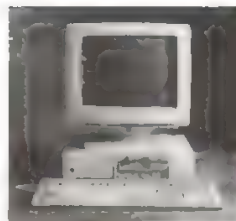
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HARDWARE DESKTOP PLOTTERS

AN EYE ON QUALITY

Despite the eye to economy obvious in the design of the Image Maker, quality is not compromised where it counts. For example, the pen carriage rides on a pair of small ball bearings and is itself cast from aluminum. One side holds a solenoid in a square plastic case; the other holds the pen. A stamped bar under the carriage raises and lowers the pen.

Perhaps the best way to appreciate the mechanical quality of the Image Maker is to watch—and listen—to it work. It goes about its business precisely and accurately, making only the slightest noise.

As a flatbed plotter, the Image Maker will accommodate any size sheet of drafting medium equal to and smaller than its B-size maximum capacity. It will draw plots as large as 10.24 by 16.38 inches.

The Image Maker uses a magnetic system to hold down the drafting medium. On the left, a hinged bar snaps down to grasp each sheet. Its hinge forms a stop for aligning the left side of the drafting medium; an arrow screened on it indicates the proper vertical position. The right side of the medium is held in place by a removable magnetic strip about 10 inches long.



Houston Instrument's HI Image Maker is an economical flatbed plotter that sports eight pens, has a magnetic paper hold, and produces high-quality output. It's slow, but it's also one of the quietest plotters around—and a bargain at \$1,295.

Both parallel and serial ports are standard equipment, with the setup of the latter accomplished by using a four- and eight-bank array of DIP switches on the rear panel of the plotter. A printed sheet of settings, affixed to the back of the Image Maker,

serves as a handy quick reference that supplements the very readable user guide.

The control panel is a small array of membrane switches to the left of the pen stalls that manages all the expected functions: manual pen control as well as sizing, orienting, and mirror-imaging plots. The frugal allotment of buttons complicates only the selection of pens, which you choose through combinations of control keys.

The electronics of the Image Maker are straightforward. Although it has a 5K internal buffer, it does not optimize pen movement. It can, however, digitize pen coordinates.



FACT FILE
EDITOR'S CHOICE

HI Image Maker
Houston Instrument, 8500 Cameron Rd., Austin, TX 78753; (800) 444-3425; (512) 835-0900.
List Price: \$1,295.
In Short: A low-priced flatbed plotter for any size media up to ANSI B with magnetic paper-holding and eight pens. Slow performance but high-quality (0.001-inch) resolution.

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Street Address
City, State, Zip
Have you ever ap
Position Desired?
Apart from abse ☐ Yes ☐ No
Are you legally eli
Other special trait
How did you learn

HARDWARE DESKTOP PLOTTERS

Performance is modest, somewhat slower than what the claimed 15.7-inch-per-second pen speed might imply. But the Image Maker's output quality is worth waiting for. It draws excellent images: the curves and diagonals of both graphics and text are as smooth as HPGL allows.

The Japan-manufactured system is FCC Class B certified and warranted for one year. Its power supply is built-in and connects through a detachable cable.

The Image Maker combines the media-handling versatility of a flatbed plotter with the precision of a drum plotter at a comparably affordable price. Its sole shortcoming is the leisurely nature of its work. If you're not in a hurry when it comes to plotting jobs, you may want to rush out and buy one.

ROLAND DIGITAL GROUP Roland DXY-1300

The Roland Digital Group may be best known for MIDI and music synthesizers, but the company also offers some amazing

FACT FILE

Roland DXY-1300

Roland Digital Group, 5300 South Eastern Ave., #110, Los Angeles, CA 90040; (213) 722-6933.

List Price: \$2,495.

In Short: A moderately expensive flatbed plotter with average performance, eight pens, and ANSI B media capabilities. Its 1MB buffer permits instant replots without tying up its computer host.

CIRCLE 423 ON READER SERVICE CARD

mechanical peripherals that range from sign cutters to milling machines. The DXY-1300 plotter shares its heritage with those mechanical marvels. Like them, it's a quality machine made to high tolerances and, at \$2,495, not particularly inexpensive.

As the "XY" in the name implies, the DXY-1300 is a flatbed plotter. It can ink any size paper up to ANSI B. Its maximum plotting area is 11.7 by 17 inches.

But the DXY-1300 doesn't have to be operated flat. Roland includes two V-shaped plastic supports that angle the flat face of the 4.25- by 24- by 16.5-inch

(HWD) machine at about 60 degrees so that it stands approximately 15 inches high. This position makes loading paper—and showing off the DXY-1300's mechanical finesse—much easier.

Overall, the DXY-1300's plastic shell (FCC Class B rated) is attractive. The only bit of ugliness in the entire design is the large external transformer required to supply the system with power.

DRIVING THE PENS

Up to eight pens can be kept ready and automatically (or manually) selected for colorful drawing. The pen mechanism of the DXY-1300 comprises a metal girder that travels along the x-axis and a plastic pen carriage that rides the girder along the y-axis. This girder, supported at both ends, is part of the reason that the system achieves an excellent mechanical resolution of 0.0005 inch.

Both the girder and pen are driven by clogged rubber belts. The solenoid that raises and lowers the pen is held on the opposite side of the girder from the pen and is contained in a square plastic case. A reinforced plastic lever connects pen to solenoid.

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Speed	8 MHz	10 MHz	12 MHz	12 MHz
Wait State	0	1	0	1
Std Memory	640 KB	512 KB	1 MB	1 MB
On-Board Video	MCGA	VGA	VGA	VGA
Monitor	OPTION	OPTION	OPTION	OPTION
Fixed Disk	OPTION	OPTION	OPTION	OPTION
Floppy	720 KB	1.44 MB	1.44 MB	1.44 MB
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Note: Information on this chart is based on published materials.

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CIRCLE 207 ON READER SERVICE CARD

HARDWARE

DESKTOP PLOTTERS

The eight self-capping pen stalls are molded as a piece from black nylon and are located at the upper half of the left side of the drafting area. Just to the left of the pen stalls is the line of eight membrane switches, which allow the manual selection of an individual pen for drawing color-specific or monochromatic plots.

Directly below the pen buttons you'll see a pair of four-character LED displays that continuously indicate the current cursor coordinates. The DXY-1300 can also digitize conventionally, sending the coordinates back to its computer host.

Below the displays is a full control panel that allows all the expected options, including manually changing pen positioning, image scaling, image positioning, and orientation.

In addition, a unique "replot" button lets you duplicate an entire plot (or a portion thereof) without tying up your PC. Since Roland equips the DXY-1300 with a full megabyte of buffer memory, replot will work with no trouble for even the most complicated plots. Surprisingly, however, this large buffer is not used for optimizing pen travel in normal operation.

There are a few controls on the unit that are relegated to the left edge of the DXY-1300. These include the easily ac-

Since Roland equips the DXY-1300 with a full megabyte of buffer memory, its unique replotting feature will work with no trouble for even the most complicated plots.

cessed power switch and a slide switch that selects whether short or tall pens are to be used. The power transformer also connects here.

OPERATING THE DXY-1300

Both serial and parallel ports are standard equipment on the DXY-1300. The connectors are discretely located in the middle of the bottom (or back, if you raise it up at an angle) of the plotter.

Loading the DXY-1300 with a suitable drafting medium requires only that you slide a sheet under its pen girder until the bottom edge of the sheet rests against a raised ledge at the lower edge of the plotting area.

Pressing a push button activates an electrostatic paper-holding circuit and



The Roland DXY-1300 can be set up to operate flat or tilted at an angle to save desk space. Priced at \$2,495, it offers electrostatic paper hold and a 1MB buffer, but only modest speed.

lights a tiny LED to serve as a reminder that the force is with you. (The electrostatic force takes some time to decay, and without the indicator, you wouldn't know if it was on or off.) The few media that won't electrostatically stick can be taped to the drafting surface.

The Japan-made DXY-1300 produces plots just as precise as its sophisticated mechanism would imply. In fact, testing imposed the artificial 0.001-inch resolution inherent in HPGL itself. The DXY-1300 also understands Roland's own RDGL, which you may find preferable (if you have software that supports it) because the DXY-1300 will tend to draw text characters of an improper size when using the HPGL language.

Despite its cost, the DXY-1300 is not a particularly fast plotter. Its pen speed is a relatively modest 16.5 inches per second, and its plotting times proved leisurely. Its warranty, too, is modest: 90 days labor, one year parts.

Since the quality, speed, and precision



EDITOR'S CHOICE

- Hewlett-Packard 7550A
- HI Image Maker

If this round of plotter testing proved anything, it is that Hewlett-Packard really knows how to build plotters. In general, the HP machines have a uniform feeling of quality and are undoubtedly the best-designed and best-made machines in this product class. The only problem is their price. Other plotters at the same relatively high price levels as the ColorPro and 7475A offer features that the HP machines do not.

That said, the best plotter examined here was Hewlett-Packard's \$3,900 7550A. It is fast, precise, and convenient. The automatic paper-feed makes it as easy to use as a printer, yet it yields the accuracy, clear colors, and smooth drawings of a plotter. Just \$50 shy of being the most expensive desk top plotter reviewed here, it can easily pay for itself in saved time and frustration.

If you have to squeeze the most out of your budget, you'll find that the cheapest machines basically have only price to recommend them. The bottom tier fails either in quality, speed, or simply quiet operation a factor that is often overlooked in feature comparisons.

The minimum list price you should expect to pay for an all-around acceptable plotter is \$1,295; at that level, our choice is Houston Instrument's HI Image Maker. Although somewhat slow, it delivers accurate, colorful drawings of virtually any size and on a wide variety of media. That is a versatility lacking in the quicker (but still useful) Fujitsu FPG-315, which is also priced at \$1,295.

of the DXY-1300 are equaled or bettered by slightly less-expensive machines, its best market lies with the people who needs its unique features, like the large buffer and the replot feature, which gives control of your PC back to you while the plotter continue to draw away. ■

Winn L. Rosch is a contributing editor of PC Magazine.

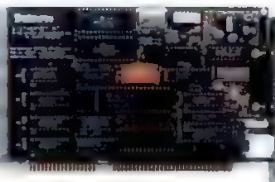
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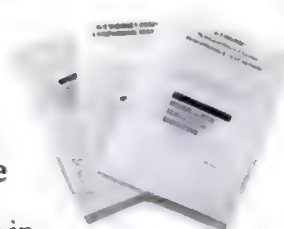


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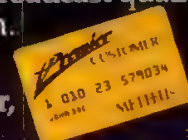
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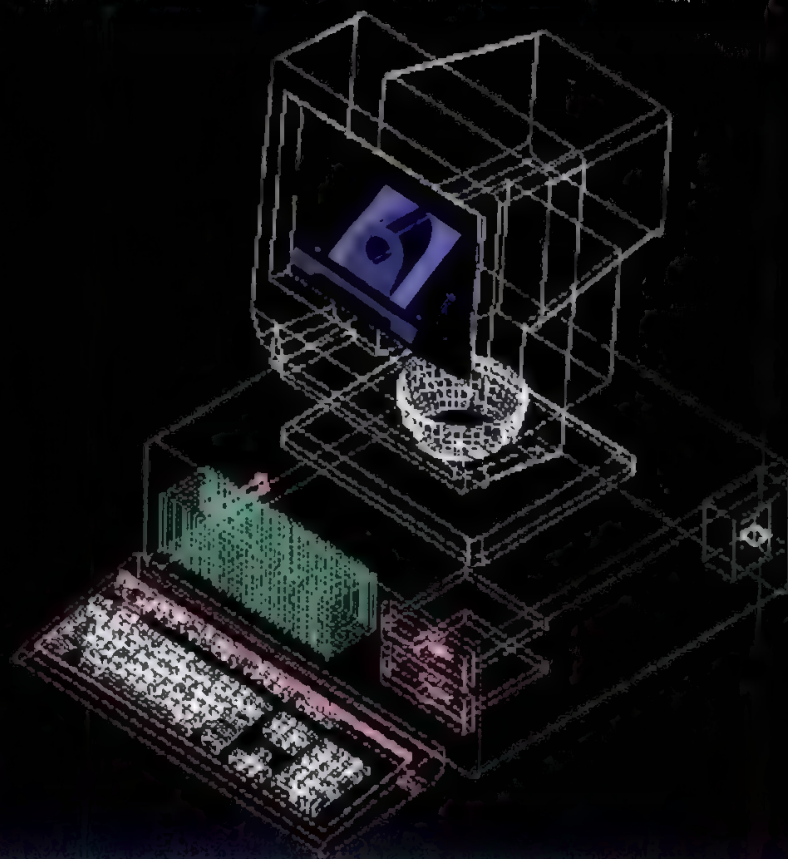
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3-D CADD

Workstation Tools for the PC Platform

My, how they've grown. *by Jeff Prosise*

Since *PC Magazine's* last evaluation of high-end CADD software, a new maturity has taken hold in the 3-D market, and the result is a group of products powerful enough to challenge dedicated minicomputer CADD systems.

Since 1982, Autodesk's *AutoCAD* has been the standard in the PC CADD (computer-aided drafting and design) industry. Established early on as the do-all package that would perform when others couldn't, *AutoCAD* gained a foothold in the marketplace that it has never relinquished. Today, with more than 280,000 registered copies (and perhaps ten times as many illegitimate copies) in use, it is still the yardstick by which other CADD packages are measured.

But *AutoCAD* may be showing some signs of age. The transition to true three-dimensionality—in which

x, y, and z axes are all treated equally—hasn't been easy. Programs like *Cad-key*, designed to be 3-D, are easier to use when it comes to creating 3-D wireframes and surfaced and solid models. Ease-of-use issues aside, *AutoCAD* is equally capable in 3-D and far surpasses the abilities of many other entrants in the marketplace. There are also several 2.5-D CADD programs on the market. They are able to take 2-D drawings and extrude them into the third dimension, but only as a means of helping you visualize the object. The mathematics behind the images remain two-dimensional.

What distinguishes the 12 high-end CADD packages we review here from the rest of the large CADD market is that each one supports true 3-D design, where any point can be identified by three coordinates: x, y, and z. We've also included brief looks at *DataCAD*, a program suited mainly for architects, and *FastCAD*, a 2-D program that is blindingly fast. With the exception of the \$399 *DesignCAD 3-D*, these products are not inexpensive: *SilverScreen*, the next-least-expensive package, lists for \$995, and most others, including *AutoCAD*, hover around the \$3,000 mark.

THE CADD PHENOMENON

CADD is to the draftsperson, engineer, or architect what desktop publishing pro-

grams are to the graphic artist or typesetter. In the same way that cutting and pasting in newsletter design has been entirely computerized, drafting and design work that once required pencils, T-squares, and triangles can now be done with a properly equipped PC, a monitor, and a mouse. Part drawings and floor plans drafted electronically are much easier to change than ones drawn on paper and in many cases require less time to create.

CADD use is now so widespread that the once-familiar sight of draftspersons and engineers hunched over boards in a drafting room is as much a memory as the slide rule. The boards have been replaced by CADD stations; the room has given way to a collection of dimly lit cubicles illuminated by the glow of monitors.

The proliferation of CADD software for the PC is largely responsible for this transformation. CADD capabilities that carried the cost of \$30,000 per seat five years ago (not including the cost of the minicomputer or mainframe to drive the software) are now available for the price of a fast PC and software. In fact, the pricing is so competitive that many engineering houses have settled on PC-based CADD

for their primary drawing-production systems, relegating mainframe CADD to backup roles processing jobs that require extraordinary amounts of CPU power.

THE MOVE TO 3-D

To be sure, you can still license CADD systems driven by mainframes and minis for \$50,000 or more, but the distinction between these and PC-based systems is increasingly blurred. One factor is PC CADD's move to 3-D.

3-D capabilities stretch the concept of computer-aided design to encompass the properties that distinguish real objects from imaginary 2-D projections. A 3-D wireframe model represents an object as a see-through collection of lines and curves in three-axis coordinate space. A 3-D surfaced model represents the same object as a collection of bounding surfaces. Once a wireframe is converted into a surfaced model, hidden lines can be removed and shading algorithms can be applied to produce life-like shaded images. The final type of 3-D model—the true solid model—represents an object as a mathematical solid. The distinction between solid models and surfaced models is rooted in mathematics, but both provide ways to represent real 3-D objects on the screen that are as mathematically unambiguous as they are visually appealing.

Anvil-5000

SUITABILITY TO TASK

2-D
drafting



3-D
modeling



Architectural
design



Mechanical
drafting



Facilities
management



3-D CADD SOFTWARE: SUITABILITY TO TASK

Which high-end CADD package provides the specific features you need the most? *PC Magazine's* suitability-to-task ratings provide one way to help you decide. These are systematic though subjective ratings provided by our reviewers; for a more complete picture of what each product offers, compare these judgments with the information in the reviews and the features table.

The Tasks

2-D drafting. Since 3-D packages aren't necessarily used exclusively for 3-D manipulation, you may want to know how complete the software's two-dimensional drawing features are, including entity supply, dimensioning capabilities, and snap commands. In this category, just about every package is inevitably compared to *AutoCAD*, the dominant player for so long.

3-D modeling. All the packages reviewed here were selected because they have

three-dimensional functionality, but their capabilities vary. Features to watch for include wireframe construction, hidden-line removal, multiple-view creation, shading, and surfacing.

Architectural design. Though our test drawing was not architecturally oriented, many of these packages include architectural features such as double-wall line

drawing, collections of construction entities, and architectural scaling.
Mechanical drafting. Drafting is the bread-and-butter operation of most 2-D and 3-D packages. It involves such aspects as the variety of editing commands, the number and quality of available line types and symbols, and the provisions for drawing assistance.
Facilities management. This category addresses the question: is the package suited for facilities managers, people who want to connect CADD drawings to databases in order to keep track of their inventories and supplies of parts?

The Ratings

0 = Lacking the feature or completely unsuited for the task.
1 = Poorly suited for the task.
2 = Somewhat capable.
3 = Well suited.
4 = Excellently suited; your best choice for the task.

As you might expect, 3-D CADD offers plenty that 2-D doesn't. 3-D models are easily converted into shaded images that give the designer an idea of what the final product will look like. Most of the CADD products reviewed here either produce shaded images or have add-ons that will. Second, packages that support the concept of instancing—where you build a single 3-D model of a part and select as many 2-D views as needed—greatly reduce the amount of time it takes to produce a working drawing. Third, CADD programs that support solid models can do more than draw pretty pictures; they can also calculate mechanical properties such as volumes, weights, centers of gravity, and moments of inertia. Finally, 3-D models expand CADD's utility in related fields such as numerical-control machining and finite-element modeling.

While each of the products reviewed here works in 3-D, you'll find that the quality of the implementations varies. Some will create wireframe and surfaced models as advertised, but make you go around the world and back to get there. Others are capable of generating beautiful 3-D models, but they separate 3-D from 2-D so that you can't easily go from one to the other. Still others work and *work well*. Spend an hour working with *Cadkey*, for example, and you'll be left wondering how 3-D design could be done any better.

True 3-D is still comparatively new to the world of the PC, and we're seeing the growing pains that accompany most of these products' transitions from 2-D-only to full-blown 3-D. CADD vendors that have decided to make the move are sticking their necks out to some degree, but they can ill afford not to. Those who aren't willing to make the commitment to 3-D will find themselves left behind in a highly competitive field.

CADD HARDWARE

While still a bargain compared to CADD on its mainframe cousins, quality CADD on the PC doesn't come cheap. In addition to purchasing of the software, you'll need to buy—at the very least—a fast 80286-based PC (though a 386 machine is required for most of these packages), a high-resolution graphics display adapter and monitor, and a mouse or digitizing tablet.

Running most of today's CADD packages on anything less than a 386 requires the patience of Job. A fast hard disk is necessary, and a math coprocessor—be it Intel, Weitek, or Cirex—is often a must.

OUR CONTRIBUTORS

Jim Boyce is a free-lance writer and senior instructor at Texas State Technical Institute, where he teaches advanced CADD and programming.

Bruce Haase is a college computer science instructor in Muskegon, Mich. He is also a CADD/CAM manufacturing consultant and senior member of the Society of Manufacturing Engineers.

Brad Holtz is a Maryland-based CADD consultant whose book, *The CAD Rating Guide*, was published last July by DSR Publishing.

Joel N. Orr, a CADD/CAM and computer graphics consultant, holds a Ph.D. in mathematics and computer science. He is also a founding member of the National Computer Graphics Association.

Jeff Prorise, a mechanical engineer, is a contributing editor of *PC Magazine*.

Will Schleter is a mechanical engineer working in the Knoxville, Tenn., area who provides software and operations support for a mainframe CADD/CAM system.

Rod Taylor is a mechanical engineer working in the Knoxville, Tenn., area. He specializes in computer-based modeling and dynamic simulation of complex 3-D systems.

Donald P. Willmott is an associate editor of *PC Magazine*. ■

Some packages won't run without them. If time is money, then the cost of high-performance hardware can be justified by the speed you gain.

It doesn't hurt to have your PC brimming with RAM, either. *AutoCAD* will use up to 4MB of extended or expanded memory. *AutoCAD/386*, scheduled to be available this spring, will use Phar Lap Software's *386/DOS Extender* to open up the vast expanses of protected-mode memory to DOS users.

The rule in graphics resolution is the more the better. IBM's 8514/A adapter established an attractive (though interlaced) 1,024 by 768 standard for which most CADD developers now provide drivers. CADD images, especially shaded ones, appear razor-sharp at this resolution. Newer adapters are pushing the top end much higher, with 1,280 by 1,024 resolu-

tion already common in workstation quarters and just beginning to appear on the PC scene. At the very least, don't try to do production CADD on anything less than a VGA system; the 640 by 480 resolution it provides is adequate for most purposes. (The screen images accompanying these reviews are VGA-generated.)

Finally, you'll be more productive with CADD (in most cases) if you forsake the mouse and invest in a digitizing tablet. The sheer complexity of most CADD programs means that there are hundreds of commands to choose from, and getting to them 10 or 12 at a time through on-screen menus just doesn't cut it (for more on digitizing tablets, see "Digitizing Tablets: Pointing the Way to Easier Input," *PC Magazine*, November 28, 1989).

STARGAZING

PC CADD's 3-D capabilities are still limited. A simple task like rotating a wireframe to get a better view is a chore with all but a few of the current crop of programs, owing in part to poor interface design and to a simple lack of graphics processing power.

But what does the future hold for PC CADD? Just look at what's happening in the graphics workstation market to get a glimpse (see "Why CADD Workstations Won't Disappear . . . Just Yet").

Today's graphics workstations, costing as little as \$20,000, let you shade models, spin them around, and move light sources—all in real time. You can mesh finite-element models with a degree of interactivity that puts today's PC systems to shame. These features will migrate down to the 3-D CADD packages of tomorrow.

No hardware advancement has the potential to further the development of CADD on the PC as much as the proliferation of fast graphics coprocessors. These boards offload display-related calculations from the CPU, allowing functions such as zooms, pans, and surface shading to be performed in hardware optimized for these purposes. On Silicon Graphics' IRIS workstations, for example, the CPU tells the graphics hardware where polygons are located in 3-D coordinate space, where the eye is positioned, and where the light sources are; the hardware responds by displaying the polygons complete with perspective, shading, and shadows. Silicon Graphics has hinted that it will soon make available a graphics board that can transform Micro Channel machines into IRIS equivalents.

In the more immediate future, look for

CADD programs ported to OS/2 to up the ante in functionality and ease-of-use. A milestone in the migration of CADD to OS/2 was Autodesk's recent release of *AutoCAD* for Presentation Manager. The new *AutoCAD*, which takes advantage of OS/2's ability to manage the execution of multiple threads within a process at once uses PM's DDE (Dynamic Data Exchange) facility to establish live links to other applications. One demonstration of this capability shows the length of a shaft linked to a value in a spreadsheet. When the value in the spreadsheet changes, so does the part drawing in *AutoCAD*. Engineers never had it so good.

Convinced? You should be. These

products have affected the engineering industry the same way desktop publishing has the publishing industry. And as we stand poised on a hardware divide that signifies the end of an old era and the beginning of a new one, the best is yet to come.

Anvil-5000

by Bruce Haase

Manufacturing and Consulting Services (MCS) has been in the CADD business for almost two decades, and it has developed an excellent reputation in the mainframe,

minicomputer, and workstation markets. For the PC-based 3-D CADD market, MCS offers *Anvil-5000*, Version 2. The product ranges in price from \$4,800 for the 3-D design and drafting module alone to \$10,400 for the complete system, which includes a 2.5- and 3-axis NC CAM milling package and finite-element modeling.

The PC version of *Anvil* is ported down from the same code used by its big brothers; it shares a user interface with its mainframe and workstation counterparts, so if you move from one to another you won't have to learn new commands or deal with different menus and icons. Your files can be easily transferred between hardware platforms as well.

What can CADD workstations do that PCs can't? In brief, very little, but the question deserves a more complete answer.

Engineering workstations are powerful computers based on microprocessors such as the Motorola 68030 or 88000, or various other RISC chips. They generally run a version of Unix, which offers the powerful combination of multitasking, networking, and some transportability of data among Unix-based workstations.

In raw mips (millions of instructions per second), workstations are considerably faster than most 80286- or 80386-based PCs. Workstations are in the 3 to 50-mips range, while PCs run in the 1 to 5 mips range.

But of course, pure processing power isn't everything. Most workstations have fewer graphics-processing options than PCs. The workstation user is limited to a small number of displays and associated processor boards; these vary in

WHY CADD WORKSTATIONS WON'T DISAPPEAR . . . JUST YET

by Joel N. Orr



resolution, speed, size, and ability to display color.

It's only at the high end of graphics processing that workstations continue to outshine PCs consistently. Silicon Graphics, Tektronix, and Hewlett-Packard all offer workstations with outstanding graphics-processing power. During a zoom, for example, their

screens can be updated in less than a second, compared to the 3 seconds or more needed for the fastest PC graphics cards.

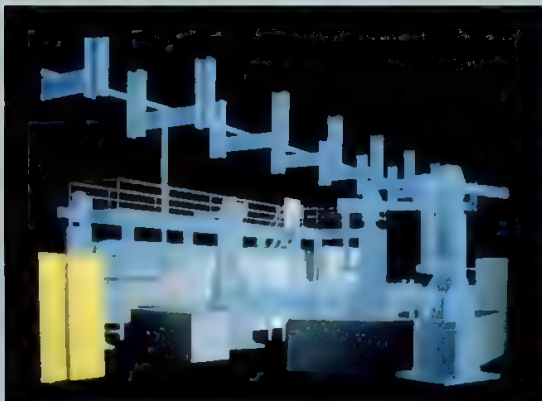
WHERE WORKSTATIONS SHINE

Computationally intensive applications, such as solid modeling and real-time animation, are better suited to workstations than to PCs. They need all the mips and mflops (millions of floating-point operations per second) they can get, as well as special hardware for displaying very large files quickly. Workstations that processed .1 mflops in 1984 can now process 5, and performance should rise to 10 mflops in 1990.

The range of available CADD software options is far greater for the PC than it is for workstations. Remember, though, that most people use only one word processor, one spreadsheet, one e-mail package, and one CADD system; if your favorite workstation has the application you need, don't let the wide range of PC-software products dominate your choice of platform.

WHAT DO YOU DO?

All things considered, many businesses will be better served by PCs than by workstations. One point to consider is that changing computers in the PC environment—say, from an 80286 to an 80386 machine—is fairly simple, as long as the graphics devices remain the same. But moving from one company's workstation to another's—from a Sun SPARCstation to a Data General AVION, for example—can be difficult because Unix versions vary from one



Auto-trol Technology's *Facility Layout/Industrial* is one example of a high-end CADD application that the PC can't handle yet. *FL/I* integrates 3-D plant layout design with a complete relational database. Adding the *FLWS* package lets you analyze material flow through your design to find production bottlenecks.

Paradoxically, that interoperability may also be *Anvil 5000's* weakest point. The program's executable file, which weighs in at over 11MB, is gargantuan. And as feature-packed and powerful as the software is, it acts sluggish in places, as if it hasn't been optimized for the PC. For example, shading is painfully slow with a standard VGA card (MCS recommends a high-resolution graphics card with extra memory, and output quality is marginal at best).

Anvil's menu system, which combines text and icons, was designed as a convenience for users, but on a standard-sized VGA monitor it's a hindrance. The icons (20 sit on the right of the screen) are ex-

platform to another, and the same object code cannot usually be run on machines from different manufacturers.

Workstations have no advantage over PCs in resolution or in networking. PCs can support very large, high-resolution displays and can be incorporated into the same kinds of networks in which workstations reside.

PCs have the edge when it comes to availability of different output devices. The PC's installed base is much larger than that of workstations, so manufacturers of output devices insure compatibility with PCs more assiduously.

PCs are also more manageable than workstations for the engineering user. Configuring a Unix workstation is not for the faint of heart, but anyone can learn the vagaries of DOS or OS/2 well enough to set up a CADD system without expert assistance. Access to the innards of most workstations is strictly for technicians, but you obviously don't have to be a power user to pop the cover off a PC.

The determining factor is this: what does the user of the workstation do? If the answer is CADD only, a fast workstation's higher performance might translate into higher productivity. Even if the system is \$5,000 more expensive than a loaded PC (and some are actually price-competitive with fully loaded high-end PCs), it could pay off. But if the user is an engineer or designer with other tasks to do on a daily basis—project management, word processing, presentation preparation—the range of applications available for the PC makes it the more attractive choice. ■

tremely small; in fact, four of them are indecipherable. When you split the screen into multiwindowed views the situation goes from bad to worse—either your text menu blocks out the upper-left view or your drawing blocks out the menu. On 19-inch screens these problems melt away; a monitor of that size is recommended.

FEATURE-FILLED PACKAGE

As a PharLap DOS-extended program, *Anvil* offers an extended geometry set with surface modeling, 3-D curves, 3-D splines that include editable splines, mass properties analysis, built-in shading, Bill of Materials handling, and *Anvil's* own programming language, GRAPL-IV.

Our 3-D test drawing didn't come close to challenging *Anvil*. Since *Anvil* is a 3-D wireframe package, lines representing an object's edges need to be constructed first. Once the wireframe of a part is complete, a surfacing operation is usually required on the face of the object before it can be rendered. I began with the base, drawing half of it and mirroring the rest.

You have to be careful about selecting the correct boundary lines for the surface you are creating. If you pick the wrong line or the right line at the wrong place, your surface will resemble a pretzel instead of parallel line sets. The more complex the drawing, the more time it takes to create surfaces. *Anvil* handles this tedious job well. Just position the cursor near your boundary during selection and press the letter "L" for line, "E" for end, "P" for point, "A" for arc, and so on. *Anvil* will pick the closest match. This snappy feature is also available when you are drawing, editing, and manipulating. It's a real time-saver.

Anvil uses a two coordinate system. The first is the standard model or world space of $x=0$, $y=0$, and $z=0$; the second is DCS (defined coordinate system). With wireframe or 3-D construction, your coordinate system's point of origin must change as you draw a part. The ease of setting up different points of origin and activating them makes or breaks a 3-D package, and *Anvil* provides an effective approach.

Once a DCS is created, a transform representing its point of origin and axis orientation is displayed on the screen and activating a second DCS makes a second transform appear. Furthermore, by clicking your mouse on the DCS icon you can

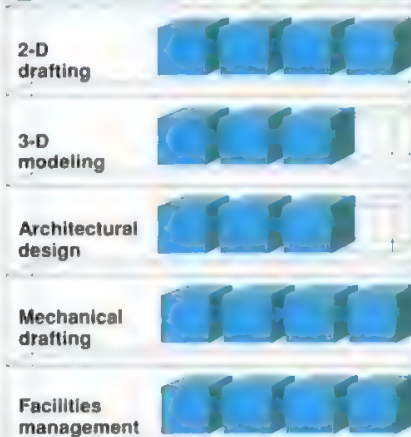
switch from one point of origin to another.

Like *AutoCAD*, *Anvil* uses levels and tracks items by type: surfaces, lines, arcs, points, and so forth. This is a blessing when you need to perform mass manipulations, deletions, or changes. Any level or type of entity drawn can be turned off and on. If necessary, just hit a couple of keys to blank all surfaces or simply pick the modify-many icon to change all line types. *Anvil* also provides a full set of drawing tools and snap commands.

Anvil can draw 2-D views efficiently and effortlessly, but there's no need to create something twice. Existing views of your 3-D drawing are projected into the Drawing Layout screen for detailing and

Anvil-5000

SUITABILITY TO TASK



dimensioning. There, any modifications made to the 3-D drawing will be reflected in the 2-D drawing.

Anvil's drafting menu includes full associative dimensioning. When you move, copy, scale, or stretch an entity, the dimensioning will adjust to match the new geometry. A full annotation symbol set is included, and ASCII text files can be imported for notes. In addition, you have full control over leaders, text placement, tolerances, witness lines, precision, dual dimensioning, and several other features.

CHINKS IN THE ARMOR

Anvil requires an 80386 processor and matching math coprocessor, a hard disk with at least 10MB of free space after the program is installed, as well as at least 2MB of RAM.

Some chinks in *Anvil's* armor are noticeable in the package's handling of virtual memory. All DOS-extender programs

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*Suggested U.S. list prices:
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HP LaserJet printer family welcomes a small addition.

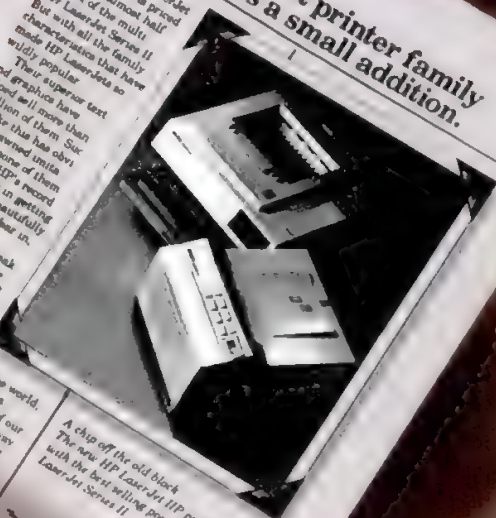
The new HP LaserJet IIP printer is priced at \$1,495*—almost half the cost of the most powerful LaserJet Series II. But with all the family made HP LaserJets that have wildly popular

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AN ILLUSTRATED GLOSSARY OF CADD TERMINOLOGY

AEC

Architecture/engineering construction.

Aliasing

A term that comes from signal processing, a subdiscipline of electrical engineering. Used in graphics, aliasing refers to "jaggies"—the stairlike steps that make up a diagonal line on a raster display. Some displays incorporate "anti-aliasing" circuitry, which reduces the visual impact of the jaggies without increasing resolution.



Associative dimensioning

The process whereby a program changes some dimensions automatically to reflect changes the user has made to a dimensioned object.

Attributes

Pieces of information embedded in a CADD drawing. They can be graphical, such as color, line type, and so forth, or nongraphical, such as part number.

B-spline

A mathematical representation for smooth curves. Compare *Bezier curve*.

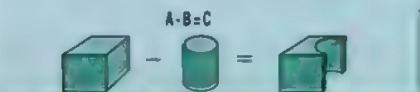
Bezier curve

A kind of smooth curve defined by four points, two of which are the endpoints. The other two do not lie on the line of the curve but attract it during interactive tracking, so that the shape of the curve is influenced by their location but retains a natural smoothness. Bezier curves are often used to design consumer products such as automobile fenders and other smooth objects.



Boolean equations

Applications of the set-theory operations of union, intersection, and complement to solid models.



Break

To make gaps in a geometric object, usually creating new endpoints; for example, removing an arc from a circle.

CADD

Computer-aided design and drafting.

CAE

Computer-aided engineering.

CAM

Computer-aided manufacturing, including numerical control (NC), robotics, and other applications of computers in the factory.

Chamfer

To join or chop two perpendicular lines with another line.



Coordinate precision

In digital computers, points in space are represented by discrete numbers. The coordinate precision is a measure of how many such points can be distinguished in a given unit of area. Sometimes precision is expressed as a linear function, as in "100 points per linear inch." Another way of specifying coordinate precision is in programming terms, as a numeric type: *16-bit integer* means that each axis can be divided into 65,536 parts (2 to the 16th power); *floating point* means that each axis can be divided into a very large number of parts. There are various forms of floating-point representation, all of which can express values of 100 million or larger.

The coordinate precision of a CADD program is what determines whether you can represent small objects that are found within large areas. For example, in a 16-bit integer system, if a plot of land that measured a mile on each side were represented in a drawing, the smallest object that could be represented in the same drawing would be .97 inches long.

Digitizing tablet

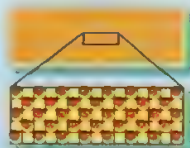
An electronic board with a stylus or puck pointer, connected to the computer. Positioning the pointer corresponds to selecting a function on a menu overlay.

Dimensions

Notations on drawings that indicate lengths and angles.

Dithering

The act of mixing pixels on-screen to simulate shades and colors that do not exist in the base palette.



Drawing

CADD drawings are close analogs of real drawings. They are 2-D representations of objects, accompanied by notations such as dimensions. Unlike a model, a drawing cannot be analyzed to determine the strength of the structure depicted.

.DXF

Autodesk's external drawing exchange file format; widely used by other vendors.

Engineering drawing sizes

The five standard sizes are: A, 8.5 by 11 inches; B, 11 by 17 inches; C, 17 by 22 inches; D, 22 by 34 inches; and E, 34 by 44 inches.

FEA

Finite-element analysis. A powerful way of analyzing physical shapes for structural, thermal, and magnetic characteristics. Objects are represented by meshes.

FEM

Finite-element modeling or meshing. See *FEA*.

Fillet

A rounded intersection between two surfaces, used primarily in mechanical engineering. In 2-D design, a fillet is a curve connecting lines or arcs in such a way that they are tangent to it. The counterpart in 3-D design is called a *fillet surface*.



Floating-point representation

A way of representing a number by a pair of smaller numbers; in this pair, the first (or *mantissa*) is to be multiplied by the base (usually 2 or 10) raised to the power of the second number (the *exponent*). Thus, 743,000 in floating-point notation would be 7.43/5, or 7.43 times 10 to the fifth power. This technique makes it possible to represent numbers larger than the maximum integer value of a single word in a computer.

Grid

A matrix of dots or lines, with user-determined spacing, that can be used to align drawing elements visually. *Snapping* allows you to use grids to force alignment.

Group

To link two entities temporarily for certain operations, such as moving or erasing. Some systems use "windows" for this purpose.

Hatching

A shading pattern made up of lines at specified spacings and angles. There are standard hatching representations for various materials—steel, aluminum, and so forth.

Homogeneous geometry

A way of representing geometry in CADD programming in which points, lines, surfaces, and solids share a common mathematical form, allowing a single set of manipulation routines to be used for all objects.

IGES

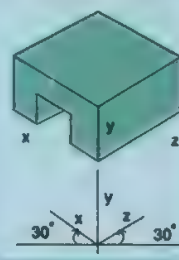
Initial Graphics Exchange Specification. A neutral (nonproprietary) CADD file format defined in ANSI standard Y14.28. CADD software vendors supply programs that translate between their formats and IGES, permitting users to move CADD files from one system to another.

ISO

International Standards Organization. "ISO dimensioning" refers to a set of drafting symbols for dimensions and rules for their placement.

Isometric view

A drawing of a 3-D object in which the y axis is vertical and the x and z axes make angles of 30 degrees with the horizontal. An isometric view is used because it gives a measure of realism while permitting measurement with the same scale along all three axes.



Layers

A way of organizing information in a digital drawing so that different versions of the drawing can be viewed and worked on separately. You can think of the process metaphorically as overlay drafting.

Macro

A collection of system commands that can be activated by a single code or button. Also used in some systems to refer to a "symbol."

Mask

To select geometry for exclusion from a subsequent operation.

MCAE

Mechanical computer-aided engineering. This usually means CADD plus FEA plus solids, with additional tools for facilitating the entire design process.

Mirror

To create a copy by "reflecting" an image of the original around an indicated axis.



Model

A 3-D representation of an object within a CADD program. A model contains representations of many of the object's attributes and can therefore be analyzed—say, using FEA tools. Contrast with *drawing*.

MRP

Manufacturing requirements planning. A computer-based method for determining materials purchasing needs, based on orders and bills of materials.

NC

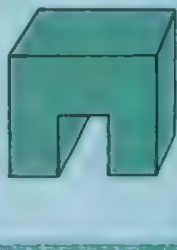
Numerical control. The control of machine tools through computers.

NURB

Nonuniform rational B-splines. A type of homogeneous geometry constrained to ensure continuity among objects.

Orthogonal view

A drawing in which a face of the object is parallel to the drawing plane, and the projection lines are perpendicular (orthogonal) to the plane of the drawing. A six-view orthographic projection is a standard mechanical drafting representation that provides views of the front, rear, left, right, top, and bottom of the object.



Pen

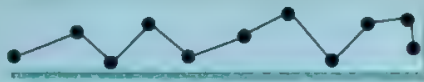
To view a different part of the image without changing magnification.

Polar coordinates

A way of specifying location by means of angles and distances.

Polyline

A geometric entity consisting of a number of connected lines.



Precision

The number of points in the coordinate space, or along each of the axes. This value determines how small an object can be represented in a given CADD system. See *coordinate precision*.

Raster

A way of representing pictures in digital form. The picture is subdivided into *pixels*, or picture elements, which are like the tiles in a mosaic. A numerical value is stored in the computer memory for each pixel, indicating its color. All PCs have raster displays. Contrast with *vector*.



Relative and absolute positioning

When locational coordinates are keyed in, absolute coordinates are numbered from the origin, while relative coordinates are numbered from elsewhere—usually from the last point entered. "Place a point at $x = 10$, $y = 12$ " is an instruction given in absolute coordinates; "place a point at a location 10 feet to the right and 12 feet up from the present point" is given in relative coordinates.

Scale

The numerical relationship between the dimensions of the image and the actual object. For example, architects often draw at a scale of 0.25 inch = 1 foot. In CADD systems, it is usually possible to draw in "real-world" dimensions; then scaling is handled dynamically by the program and is transparent to the user.

Snap

Snap is like point placement magnets: a snap is a point on the screen to which you can move any object you are placing. A CADD user might want to snap an image to a point at the end of a line, to a midpoint, or to the intersection of two lines. Systems that have snaps usually allow the user to set the snapping range.

Solid modeling

Also called *volumetric modeling* and *geometric modeling*. Of the three main forms of computer-based geometry—wireframe, surface, and solid—solids are the least abstract and hence the most realistic. But they are also the most processor-intensive to draw; interactive solid-modeling systems are therefore very expensive. Only solids allow you to check interference and accurately analyze the mass properties



of the geometry. The two main types of solid-modeling systems are CSG (constructive solid geometry) and *b-rep* (boundary representation). A CSG system stores only Boolean equations; the system creates geometry by evaluating the Boolean expressions. A *b-rep* system actually stores the geometry.

Spline

Technically, a parametric polynomial curve whose points obey certain constraints. Used loosely to mean *curve*. See *B-spline* and *Bezier curve*.

Surface modeling

Required for NC models, surface-modeling systems demand more computational power than wireframes do and are less natural for designers to use, but they are more adaptable than solids. Surfaces are often defined by sweeping one curve along another. When shaded, surface models are indistinguishable from solids. But surfaces can be used to create objects within the computer that are topologically impossible to build (like the ones in M. C. Escher's drawings), while solids cannot.

Symbol

A grouping of geometry and text can be named and stored as a symbol in most CADD systems. It can then be recalled and placed in a drawing, at any scale and angle. Many systems store only a reference to a symbol within the drawing file, so that if the definition is changed, all drawings containing the symbol reflect the change. Some systems also allow symbols to be "exploded" into their component parts, which then become like any other geometry. Also known as a *block* or *component*; in some systems, a *macro*.

Vector

As an adjective, contrasts with *raster*. The vector approach to computer graphics entails the decomposition of images into edges; the program stores the coordinates of the endpoints of each edge rather than the entire line. All CADD systems store drawings and models in vector format. There are vector input, display, and output devices; a pen plotter is a vector output device.

Window

A "virtual terminal" giving the user an access port to the system or data. Windows can be used in some systems to hold different drawings or models; in others, only views of a single drawing or model can be simultaneously displayed. Windows are also used in some programs as a mechanism for grouping drawing elements.

Wireframe

A computer representation of a 3-D object in which only the edges are represented. Contrast with *surface modeling* and *solid modeling*.



Witness lines

Lines extending out from a dimensioned object so that the dimension-labeling text can be placed where it will be legible.

require some type of virtual memory space unless you have sufficient RAM to hold all of the executable, drawing, and overlay files. *Anvil*'s virtual memory requirements amount to between 6MB and 12MB of empty disk space; this empty disk area is used for scratch files, temporary storage, and swapping.

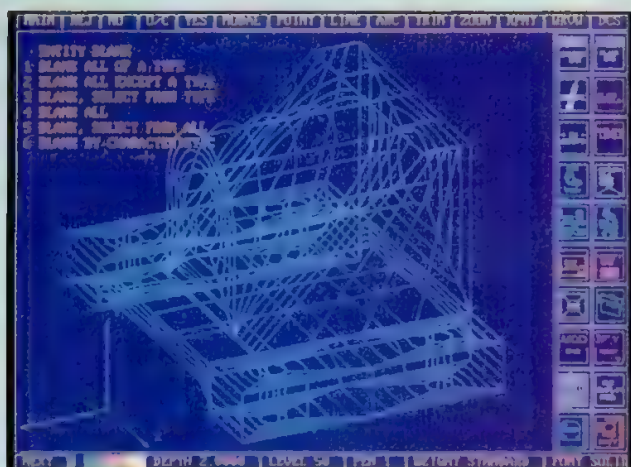
But the problem isn't that *Anvil* requires this space; it's what happens when you run out of room. At start-up, *Anvil* checks your disk for sufficient free space; if it's lacking the program refuses to run. That's fine, but things change when you're close to—but still above—the reserved virtual disk space limit. The program loads itself into memory, but as your drawing grows in size and you move below the reserved disk storage limit, *Anvil* prevents you from saving your work. It doesn't matter that your disk has several megabytes of empty space—*Anvil* has put this on reserve and won't allow anything to be stored there. As far as *Anvil* is concerned your disk is full.

The same problem pops up if you push *Anvil* to its calculation limits (during shading, for example). As the program begins to swap things to virtual memory, you might find yourself locked up. You'll have to reboot, losing everything since your last save.

In fairness, MCS does discuss the need for plenty of empty disk space in its installation manual and in the README files on the installation disk, but there's got to be a better way.

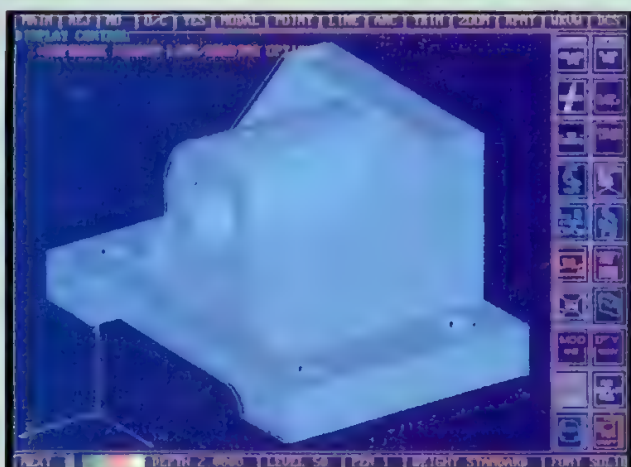
Other problems are minor irritants. For instance, the interface lacks uniformity in some of the submenus: in some menus the Return key completes your choice and starts the command; in others, you must press the Return key and then the O/C (operation complete) key. In still others, you need to press the O/C key or icon twice before anything happens.

You may also have a hard time getting



Anvil-5000 excels at 3-D wireframe construction. It has handy tools for making fast line-to-line or line-to-point connections, so drawing is quick.

The subtle shading achieved with *Anvil-5000* is fairly easy to implement once the proper surfacing operations are completed.



FACT FILE

Anvil-5000, Version 2.0

Manufacturing and Consulting Services Inc., 6 Hughes, Irvine, CA 92718; (800) 556-1234 ext.116 (outside Calif.), (800) 441-2345 ext.116 (inside Calif.), (714) 951-8858

List Price: \$4,800; Extended Geometry, \$3,200.

Requires: 4MB RAM, 80386 processor, math coprocessor, mouse or digitizing tablet, DOS 3.0 or later.

In Short: This powerful package can handle anything you need to do, but it requires massive amounts of memory and lots of room on your hard disk to do it.

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used to having the Escape key act as the erase key. I accidentally pressed it more than once, deleting plenty of the entities previously drawn in the process.

On the plus side, *Anvil*'s installation is simple; the documentation and tutorial are excellent. The program is as powerful as a Mack truck and carries more features than several of the other 3-D packages.

New users will like the icon approach. Old friends from other platforms will appreciate the familiarity of the interface and command set. And everyone will approve of *Anvil*'s open data structure, its ability to transfer information across any platform, and its exceptional editing facilities. Just make sure that you set up a vigorous disk maintenance routine, save drawings religiously, and have the appropriate hardware.

AutoCAD

by Jeff Proslise

Ask the average spreadsheet or database user to name one CADD program and the answer will probably be *AutoCAD*. This popular software lets you do just about everything from electronically crafting 2-D drawings and layouts to transforming generic 3-D wireframes into striking shaded models.

AutoCAD, Release 10 (\$3,000) is now supported under no fewer than eight different operating systems—DOS, OS/2, VAX VMS, Xenix, Ultrix, Macintosh, Sun, and Apollo Aegis—and it supports virtually every display adapter, printer, plotter, and input device under the sun. The availability of hundreds of third-party add-on prod-

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Windows menu system means you'll learn fast. If you can use Windows you can quickly use Windows CAD.

Multiple viewports allow you to work on up to four views of your drawing at the same time.

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Mouse prompts tell you exactly what each mouse button does.

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Quick to learn, easy to use. Windows CAD lets you take full advantage of your Windows experience. If you already use Excel, Pagemaker, Micrografix Designer, or any Windows package, Windows CAD will have you doing precise, accurate CAD design in no time. And of course you can use all of the plotters, printers and video devices that work with Windows.

From a proven line of CAD products. Windows CAD is the latest in a full line of highly rated CAD software that includes Drafix CAD Ultra, Drafix CAD QwkStart and Drafix 3-D Modeler.

Order your copy of Drafix Windows CAD today! Now if you have Windows you can have the full power of true CAD. Drafix Windows CAD. Only \$695. For more information call us today at 1-800-231-8574 or (816) 891-1040. CIRCLE 193 ON READER SERVICE CARD

Drafix Windows CAD has features you usually find in packages costing 8 times as much!

Item Attributes ☐ 256 layers ☐ 8 colors ☐ 9 linetypes ☐ Up to 60 database attributes to any entity ☐ Multiple line widths

Drawing Features ☐ Lines: single, double, tangent, parallel, perpendicular, multiple width ☐ Arcs/Circles ☐ Curves/Splines ☐ Polygons and Polylines ☐ Ellipses ☐ Pointmarkers ☐ Freehand sketching

Input Methods ☐ Windows menu system ☐ Keyboard equivalents ☐ Ortho lock ☐ 10 item and grid snaps, including eadpt, midpt, tangent and more ☐ Keyboard entry of coordinates ☐ OOPS (Undo) feature ☐ Dynamic Drag ☐ Quick zoom/pan ☐ Multiple viewports, all active

Powerful Editing Features ☐ Trim entities to each other ☐ Stretch ☐ Fillet (round) ☐ Chamfer (bevel) ☐ Erase ☐ Copy ☐ Move ☐ Mirror ☐ Rotate ☐ Arrays ☐ Select items by region, entity, attribute or combinations

Associative Dimensioning ☐ Linear, Radius, Diameter ☐ Single, Continuous, Baseline ☐ Ordinate, Elevation or Bearing format ☐ 23 terminator types ☐ Any alignment ☐ Tolerancing ☐ English and metric ☐ Fraction or Decimal

Associative Crosshatching and Solid Fill ☐ 15 crosshatch patterns, ANSI specs ☐ 64 solid fills

Text Editing ☐ Word processing window ☐ Multiple font styles

On-Line "Help" system

Macro Programming Language

System Requirements ☐ '286 or '386 processor ☐ Microsoft Windows 2.1 or later ☐ 1 Mb internal memory or greater ☐ Windows-supported mouse

File Compatibility ☐ Autocad DXF ☐ Drafix CAD ☐ MPGL ☐ CDF, SDF for database information



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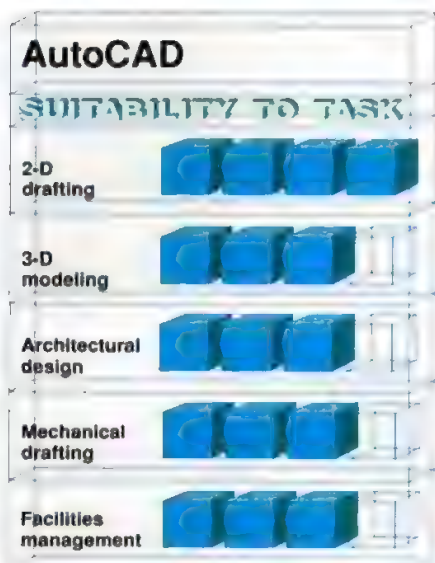
Excel, Pagemaker and Micrografix Designer are trademarks of their respective companies.

ucts makes it perhaps the most extensible piece of software ever written for the PC.

Yet despite all its strengths—and there are many—*AutoCAD* is far more versatile in 2-D than in 3-D. Although most often it will let you do what you want in 3-D, you must sometimes travel a circuitous route to reach your goal. Despite the vast improvements in 3-D construction options that Release 10 offers over Release 9, it's still more difficult to do basic 3-D tasks in *AutoCAD* than it should be.

INSTALLATION AND INTERFACE

Installing *AutoCAD* involves nothing more difficult than copying the contents of several diskettes to your hard disk. Configuration is an equally uncomplicated process and is handled from the program's main menu. A special Installation and Performance Guide is, like all the other *AutoCAD* reference and tutorial manuals, a shining example of how high-quality software documentation should be written.



Every *AutoCAD* action centers around a command. There are two ways to get at any command: either select it from an on-screen menu with a mouse or type it in. A subset of the command set is available in pull-down menus located along the top of the screen. With a digitizing tablet, you have the option of selecting commands directly from the tablet overlay.

Several selections contained in the pull-down menus invoke icon menus and dialog boxes. Select the Set Viewports option under the Display menu, for example, and up pops a window with all the different screen configuration options. All you have to do is click on the one you want, and *AutoCAD*

toCAD takes care of the rest.

The user interface is highly programmable. You can completely rearrange *AutoCAD*'s menus to suit your own tastes. You can even create your own commands using *AutoCAD*'s powerful programming language, AutoLISP. Autodesk's guide to the AutoLISP language is so thorough and so well-written that you don't have to be an expert to begin writing short programs that will make your job easier.

DRAFTING IN 2-D

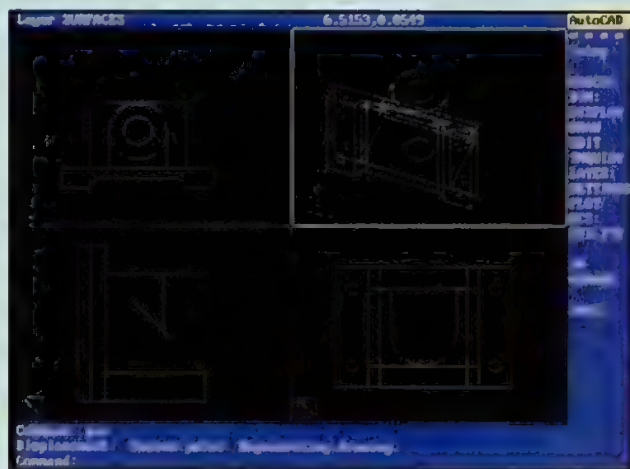
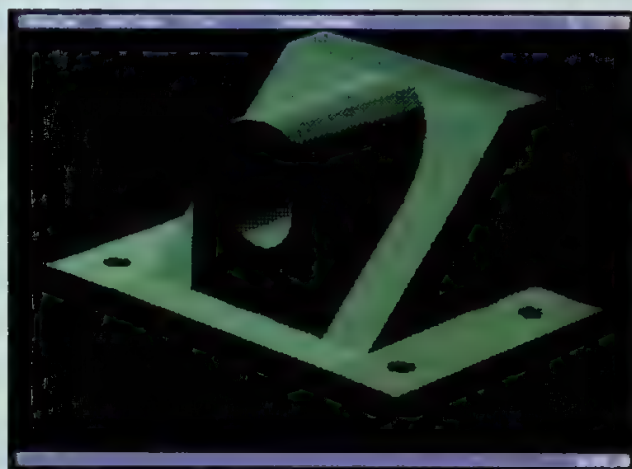
It was easier to generate the 2-D mechanical part drawing required for this review from scratch than to first create a wireframe model and then select orthogonal views from it. The preferred way to instance orthogonal views of a wireframe into a flat drawing in *AutoCAD* is via a supplied AutoLISP program called PROJECT.LSP, which projects entities onto a

plane and stores the result as a block. One problem: PROJECT doesn't work with all entity types—3-D entities mesh and extruded surfaces are excluded. As a result, you end up recreating portions of the information for all but the simplest of wireframes.

Once the issue of how to go about doing it was settled, creating the test drawing was a breeze. *AutoCAD* will do just about anything in 2-D. Snap grids, which can be set to any spacing and aspect ratio you like, make it easy to lay in lines. Features such as filleting and trimming work with all types of entities—not just lines—so you don't get any nasty surprises when you begin refining your layouts. There are a myriad of dimensioning options, and the dimensions themselves are associative, so if you later return to change what you've done the dimensions scale right along.

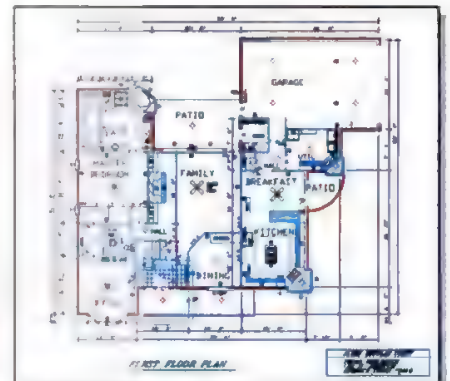
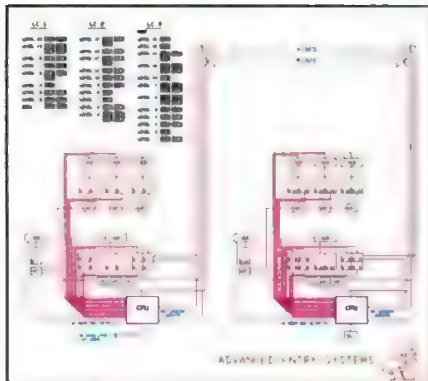
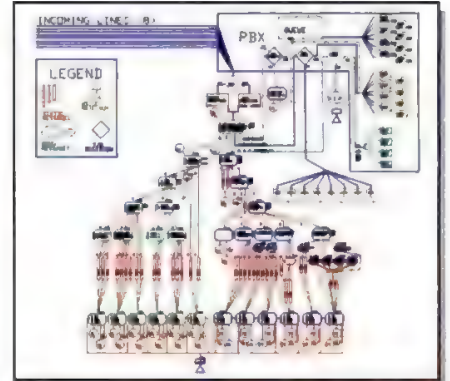
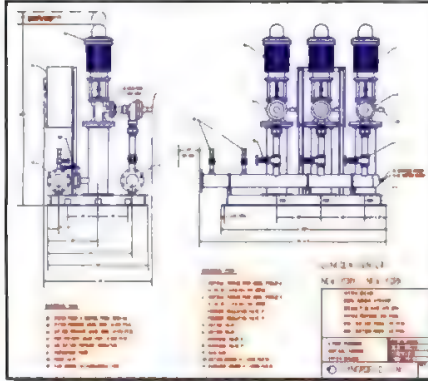
AutoCAD is strong on information handling, too. Textual attributes can be attached to blocks and written out as data-

This shaded image was produced by *AutoShade*, an optional addition to *AutoCAD*. Before the part was shaded here, the surfaces were applied in *AutoCAD*.



An *AutoCAD* screen can be divided into up to four viewports, each showing a different view of a 3-D part or a different portion of a 2-D drawing.

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base files, a feature that's particularly attractive for architectural applications.

One minor annoyance is that dimensioning parameters such as text height, extension line offsets, and the size of center marks are stored in system variables with cryptic names such as DIMTXT, DIMEXO, and DIMCEN. With more than 30 variable names and meanings to memorize, plan on keeping the manuals ready by your side until you learn your way around the system.

FROM LINES TO WIREFRAMES

The tool you'll use most often in generating 3-D wireframes is the User Coordinate System (UCS). UCSes can be oriented at any angle and location in space to effect a convenient frame for constructing 3-D entities. While all of Release 10's entities are inherently 3-D, not all of them can be created in typical 3-D fashion. To create an arc that doesn't lie in the current construction plane, for example, you must first create a new UCS (or recall an existing one), then lay in the arc as if you were working in 2-D. This makes many 3-D operations more of a chore than they should be.

In order to sell as many CADD packages to as many users as possible, vendors of mainstream PC-based CADD programs don't usually strive to include many industry-specific features in their software. Rather, they make sure that the majority of basic CADD tasks, architecture- or engineering-based, can be handled by their packages' normal feature sets.

But what about the circuit board designer? The architect? The land surveyor? The facilities manager? The civil engineer? A thriving aftermarket of CADD add-on software packages exists to service the needs of these "vertical" CADD users. Like clip-art packages that let you add all kinds of ready-made art to your desktop publishing projects, CADD add-ons offer incredibly specific functions and features designed to meet the requirements of all kinds of CADD specialists. Some are specific to one program, and some can be used by a variety of CADD packages.

AutoCAD, with the lion's share of the CADD market, is the biggest beneficiary of add-on software. DCA Engineering Software, for example, sells

GRAPHICS

3-D CADD



FACT-FILE

AutoCAD, Release 10

Autodesk Inc., 2320
Marinship Way,
Sausalito, CA 94965;
(800) 445-5415, (415)
331-0356.

List Price: \$3,000;
AutoShade, \$500.

Requires: 640K RAM,
math coprocessor, DOS 2.0 or later. Mouse or
digitizing tablet recommended.

In Short: The industry leader, and not by
accident. *AutoCAD* will do virtually anything from
2-D layouts and drawings to 3-D wireframe
models. Strong on 2-D, *AutoCAD* is a winner as a
drafting system, but falls in the middle of the pack
if your needs lean more toward 3-D.



CIRCLE 427 ON READER SERVICE CARD

An example of this inconvenience is found when applying a fillet to a 3-D corner. The fillet is always applied in the plane of the current UCS. Filleting a corner on three sides requires switching among three different UCSes. In some other 3-D programs, you can more easily

apply the same fillet by switching to a view that shows all three adjoining lines and then selecting them in sequence.

You can offset a construction plane normal to the current UCS by specifying an elevation and, if you like, have any geometry you create automatically extruded in the z-direction by specifying a thickness. The process of generating the 3-D wireframe for this review involved defining one UCS looking into the front of the part, one looking into it from the side, one in the plane of the inclined surface, and one looking in from the bottom. The base was created by activating the first UCS and drawing a profile with the elevation and thickness set to 0, and then making a copy of the profile behind the first and connecting the two with lines.

The wedge that sits on top of the base was created by switching to the second UCS and drawing a five-sided polygon, duplicating it, then joining it to the copy. The intersection of the cylindrical boss and the inclined surface was defined with a half ellipse in the third UCS, and the circles that form holes in the base of the part were defined in the fourth.

ADDING ON TO CADD

by Donald P. Willmott



three add-on product lines for *AutoCAD*: Architecture, Civil Engineering and Surveying, and Structural. Each line includes several modules, such as plumbing and electrical in Architecture, and digital terrain modeling and highways in Civil Engineering. All the programs reside within *AutoCAD* for seamless operation and are priced between \$495 and \$1,995. Contact DCA Engineering Software Inc., P.O. Box 955, Henniker, NH 03242; (603) 428-3199.

Several file and drawing managers are available for *AutoCAD*. One of the best is *Slick!*, a \$95 to \$250 (four versions, varying in capability) add-on

from CADSystems Unlimited. *Slick!* sets up a point-and-shoot shell with which you can avoid *AutoCAD*'s clunky File Utilities menu. Browsing through your collection of drawings becomes faster and easier. Contact CAD Systems Unlimited Inc., 5201 Great America Pkwy., #443, Santa Clara, CA 95054; (408) 562-5762. You can also see a First Looks review of *Slick!* in the October 31, 1989, issue of *PC Magazine*.

Fastcut Numerical Control Services has a few add-ons for *Cadkey* users. *FastSURF*, for example, is a \$1,895 surface modeler that lets *Cadkey* model free-form parametric bi-cubic polynomial surfaces. By using industry-standard surface entity types, the importation of files to mainframes and workstations is made easier. Contact Fastcut Numerical Control Services, 550 Carson Plaza Dr., #107, Carson, CA 90746; (800) 752-2457, (213) 329-4449.

The *LunaSeries* of products from American Imaging Services helps users of any CADD package, and non-CADD users as well, go back and forth between raster and vector data. *Luna-*

Why go to the trouble of drawing a profile, copying it, then joining the duplicate to the original when an extrusion would accomplish the same end in less time? Because drawing wireframe objects as extrusions in *AutoCAD* limits you later on. The result isn't a true wireframe but a mixture of lines and surfaces, and *PROJECT* doesn't work with extrusions.

SURFACE APPEARANCES

For converting wireframes to surfaced models, *AutoCAD* supplies a collection of surfacing commands.

The *3DFACE* command creates the basic *AutoCAD* 3-D surface entity, an opaque 3- or 4-sided polygon. *REVSURF* creates a surface of revolution by swinging a polyline around an axis. *TABSURF* creates a tabulated surface by sweeping a profile curve along the length of a direction vector. *RULESURF* creates a surface between two curves in space and *EDGESURF* creates a Coons patch surface among four bounding curves. If you like, you can use the *3DMESH* command to create contoured surfaces by defining meshes of points to serve as vertices and

applying built-in smoothing algorithms to round the rough edges.

The only problem is that surfacing a typical wireframe is a time-consuming process because surfaces must be applied by hand. Unless you can write your own *AutoLISP* routines to help out, surfacing around holes is particularly painstaking. Autodesk supplies an *AutoLISP* program called *SLOT.LSP* to aid in the surfacing in and around holes and slots, but there are many cases when it won't help—when the hole doesn't go all the way through the part, for example. I surfaced around the holes in the test part by dividing each of the circles that represents a hole into eight arcs; in turn, I used each arc as one side of a Coons patch surface.

Once surfaces are applied, you can remove hidden lines in *AutoCAD* or transport the model to the optional *AutoShade*. Lights and cameras are positioned in *AutoCAD* and the resulting output files processed in *AutoShade*. The result: beautiful shaded images that depict the part far better than a wireframe ever could.

AutoCAD passed the hatching test with flying colors. For good measure, we also asked it to read back the .DXF test file it had created earlier. As you would expect (since Autodesk defines and maintains the .DXF specification), the resulting image was identical to the original.

If you need a 2-D drafting and design package that's a solid performer all around, you can't go wrong with *AutoCAD*. It's one of the best. Whether you want a package to do architectural floor plans or to draw complex mechanical part assemblies, *AutoCAD* will perform. But when it comes to 3-D work, *AutoCAD* is not the most capable product nor is it the easiest to use.

Cadkey

by Jeff Prossie

While *Cadkey* may not be as well known as its venerable competitor *AutoCAD*, it doesn't take a back seat to it in any category. Aimed primarily at the mechanical engineering market, but versatile enough to serve in almost any CADD application,

View, for example, lets non-CADD users look at CADD drawings on a LAN without having to use CADD software to do it. *LunaRedline* lets those same people annotate a drawing so it can be sent back to the designer for modification. *LunaTrace* converts .PCX (raster) files to .DXF (vector) files, but only on a small scale. *LunaSketch*, \$79.95 by

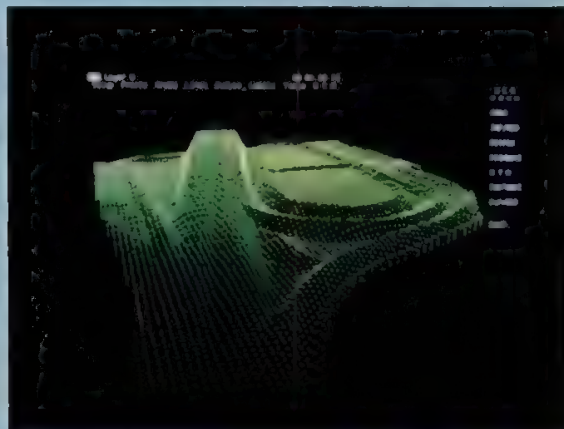
itself, does the same for larger (size C, D, and E) drawings, but only those that are not too densely packed with data. The programs can be purchased in a \$2,185 bundle. Contact American Imaging Services Inc., 2315 Luna Rd., Carrollton, TX 75006; (214) 484-3339.

No matter which high-end CADD package you intend to buy, check with

the vendor to see if it has a catalog of third-party add-ons designed to take the package into your industry-specific area. As more of these add-ons become available, CADD programs are recasting themselves as engines for vertical applications and expanding their usability without having to expand their basic code. ■



DCA Engineering Software's *Auto-Architect* add-on program for *AutoCAD* provides the tools you need to turn your architectural plans into spectacular 3-D constructions.



A series of Civil Engineering and Surveying add-on modules, also from DCA Engineering Software, are equally well equipped. This screen shows digital terrain modeling at work.

Cadkey proves that a 3-D drafting and design package doesn't have to be difficult to use just because it's feature-rich.

The \$3,195 list price of *Cadkey*'s product includes two hefty reference manuals; *Cadkey Solids*, an add-on that allows you to turn 3-D wireframe models into beautiful shaded renderings; and *Cadkey Tutor*, a disk-based tutorial package.

The first thing you'll notice about *Cadkey* is its superb user interface. A menu on the top-left corner of the screen lists all the commands available at the current level. On the bottom half, 24 of the most frequently accessed control parameters are permanently displayed in a two-page menu so you can get to them quickly. One click of the mouse toggles an individual control on or off, or pops up a selection menu or system prompt when more than one option is available.

Cadkey's command menus are robust and organized in a logical manner, and using a mouse with the program is as easy as

using a digitizing tablet. Each time it prompts you to pick a point on the screen, *Cadkey* displays a snap menu that lets you designate the snapping mode; you don't have to go to a separate menu. All drawing commands are inherently 3-D, so if you want to create a three-point arc that lies outside the current construction plane, you can key in (or pointer-select) the coordinates of the three points—a refreshing change from programs that make you set up a coincident construction plane first.

Commands can be selected via function keys, and to make operations faster *Cadkey* assigns more than 30 of its most frequently used commands to Ctrl/Alt-key combinations. Ctrl-F, for example, saves the current file to disk, while Alt-W initiates a windowed zoom. You can also record keystroke macros and automate complex tasks with the built-in CADL programming language. *Cadkey*'s empha-

sis on economizing keystrokes results in reduced drawing time.

The *Cadkey* screen can be split into up to 16 viewports; views can be chosen from eight predefined views (six orthogonal, one isometric, and one axonometric) or created by rotating the part through any angle around any axis in 3-D space. Drawing operations can be performed in any of the displayed views and can even span viewport boundaries.

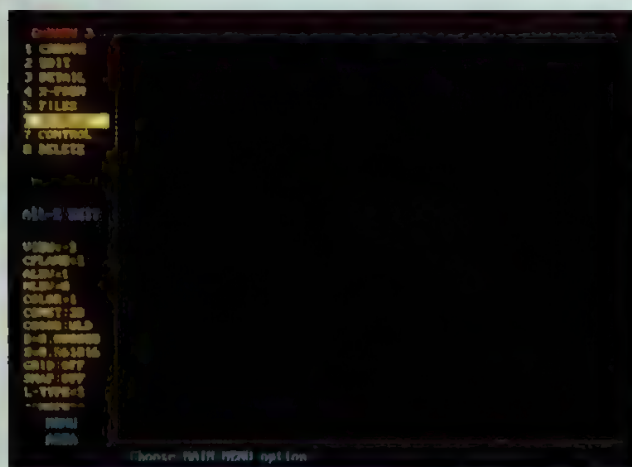
WIREFRAME MODELING

Cadkey fully supports instancing, in which you build a single 3-D model of a part and derive as many 2-D orthogonal views from it as needed. Creating the mechanical drawing required for this review was a simple matter of generating a 3-D model, taking snapshots of it (called pattern files in *Cadkey* parlance) from three different directions, and reading the pattern files into a blank drawing. Once there, objects imported through pattern files can be edited and dimensioned just like objects created from scratch.

Cadkey made creating a wireframe of the 3-D test part a snap, requiring only 30 minutes. The key factor is the program's powerful X-FORM command, which permits you to extrude 2-D geometry into three dimensions and project entities in one plane onto the surface of another—even if the second plane lies at an angle to the first.

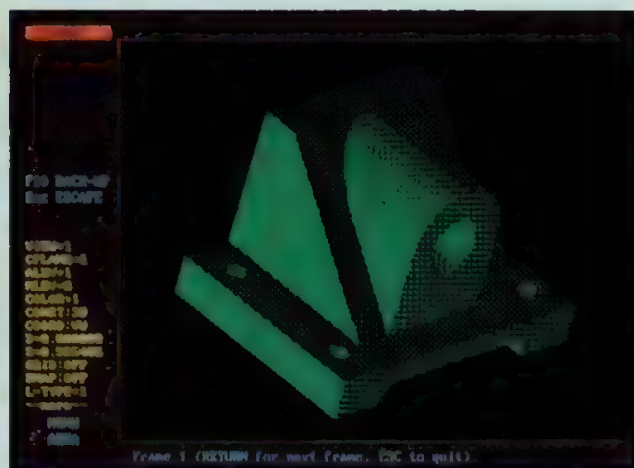
The model came together in four distinct stages. The base was first created by extruding a frontal profile using X-FORM/JOIN. Similarly, the wedge that sits above the base was extruded from a five-sided polygon. For the cylindrical boss with the hole through the center, I drew two lines and a half circle and projected them onto the inclined surface with the X-FORM/PROJECT command. *Cadkey* not only handled the projection with ease, it also calculated the curves of intersection and joined the resulting curves up to the original ones. Finally, I created the five holes in the part by extruding circles through the thickness. The result is a complete 3-D wireframe model, composed in less time than I would have believed possible. 3-D construction just doesn't get any easier.

Cadkey's 3-D strength does not come at the expense of functionality in 2-D. Dimensioning is fast, easy, and flexible. Special symbols such as plus or minus signs can be entered on the numeric keypad, and a built-in line-oriented text editor



This wireframe rendering of the test part produced in *Cadkey* is ready to have its surfaces applied. For that, it's best to export the drawing to *Cadkey Solids*.

Cadkey Solids takes the work out of producing images like this by automatically converting most wireframes to surfaced models in just a few steps.



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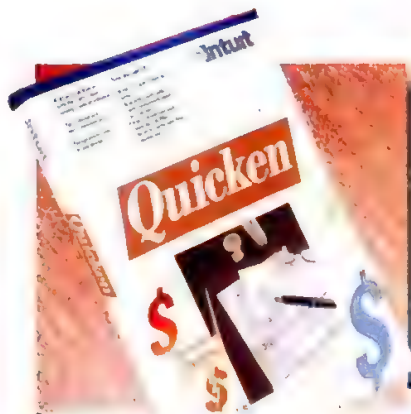


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makes adding and editing notes a breeze. And when you want to import a pattern file, you don't have to remember filenames: *Cadkey* lets you choose from a list.

A SOLID COMPONENT

Cadkey Solids is more than just a rendering package. In addition to lending wireframe models more visual appeal by removing hidden lines and shading surfaces, it also calculates properties such as volumes, centers of mass, and moments of inertia. But perhaps more significant is the way it creates them. Rather than leaving you to surface models by hand, *Cadkey Solids* will generate surfaced models directly from your wireframe geometry.

If you wonder why that's important, consider this: surfacing a simple cube with a hole through the center in *AutoCAD* involves manually meshing up the two surfaces that the hole penetrates with a number of smaller polygons, then applying 3DFACES to the remaining four sides of the cube—a process that takes perhaps half an hour. In *Cadkey*, the same process is done entirely by the *Solids* software and is accomplished in minutes.

Solids also permits you to craft models interactively using an array of built-in primitives including cubes, cylinders, spheres, cones, and wedges. While the whole process could be streamlined by making *Solids* a part of *Cadkey* rather than a separate program, the conversion is still relatively painless and the results are well worth the effort.

Solids applies a remarkable degree of intelligence to interpreting wireframe models. A circle extruded into a cylinder with the X-FORM/JOIN command, for

GRAPHICS 3-D CADD

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Cadkey Inc., 440
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(800) 654-3413, (203)
647-0220.

List Price: With
Cadkey Solids and
Cadkey Tutor, \$3,195.
Requires: 640K RAM,
DOS 2.0 or later. Math
coprocessor and mouse or digitizing tablet
recommended.

In Short: *Cadkey* leads the way in 3-D CADD on the PC with a superb user interface, excellent 2-D drafting and detailing capabilities, and 3-D features that take a back seat to none. Copy protected.



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example, is automatically recognized as a cylinder. If the same cylinder is contained within a solid and its ends lie in the planes of the surfaces that bound the solid, it is recognized as a hole.

However, *Solids* isn't perfect. There are some wireframe geometries it can't convert—Coons patch surfaces defined by four bordering splines, for example. But admittedly, that's asking a lot. Complex surfaces that *Solids* can't mesh on its own can be meshed in *Cadkey* itself, then transported over. *Solids* can be finicky about wireframe geometry at times, and errors are sometimes difficult to diagnose. But after working with the package for a while, you learn certain construction techniques that minimize the number of errors encountered in going from wireframe to solid, and that make wireframe geometry more transportable.

Cadkey supplies eight different hatching patterns, and the program successfully hatched our arrow-shaped test region without violating its boundaries. The only glitch in *Cadkey's* input of the .DXF test file was the misplacement of some dimensions and dimension text. All geometry came through intact.

OUTDATED DOCUMENTATION

If *Cadkey* can be legitimately criticized in any one area, it's documentation. The first time I tried to run the program after following the installation instructions in the Quick Start guide, *Cadkey* bombed with the message "Software Interface Module Not Installed". The appendix on error messages didn't mention this one. It turned out that the package is copy protected by a

parallel port key—yet nowhere in the manual did it say that such a device existed. Fortunately, the technical support staff is friendly, courteous, and knowledgeable, but when you pay over \$3,000 for a software package, you expect it to work and you expect the quality of the documentation to be high.

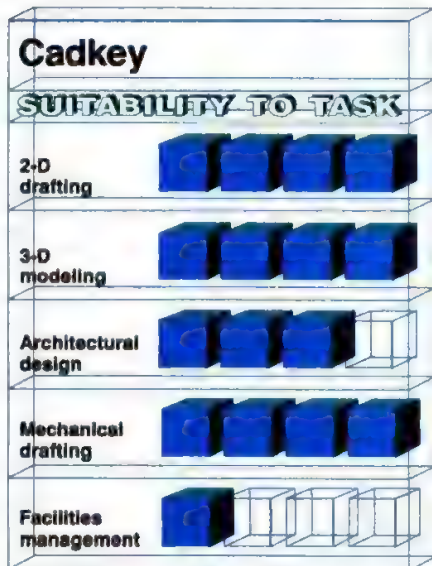
However, *Cadkey* delivers in every respect; it's capable of doing all the little things right that spell the difference between a good program and a great program. *Cadkey* is superb both as a 2-D drafting system and as a 3-D modeler, and it offers most of the features of *AutoCAD* and *AutoShade* for a little more than the price of *AutoCAD* alone. If *Cadkey* can bring the written documentation up to match the high standard of the program itself, there's no reason that *Cadkey* shouldn't become the premier 3-D CADD product of the '90s.

CADmax 3D

by Brad Holtz

Vector Automation's \$3,950 *CADmax 3D* is a powerful mechanical design-and-drafting system that excels in text editing and 3-D dynamic view manipulation. With the addition of the optional *TrueSurf* module (\$1,250), it becomes a full-featured modeling package.

CADmax 3D was
designed to be
installed by a dealer,
but if you insist on
doing it yourself,
Vector Automation will
help you over the phone.

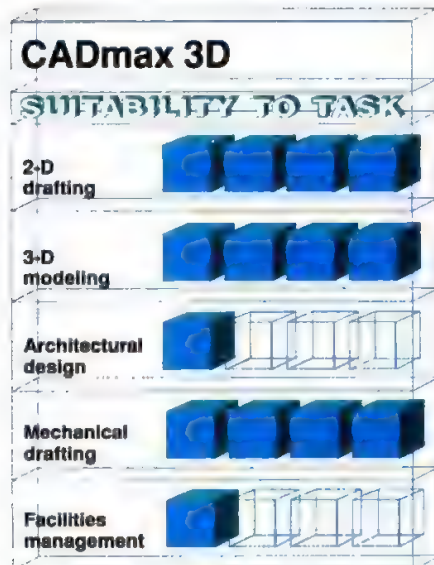


yourself, Vector Automation will help you over the phone. Installation and configuration can take about 40 minutes.

CADmax 3D has very specific needs when it comes to video boards. The program makes use of multiple video planes to put the cursor, highlights, and grid on different planes. This allows freedom for cursor movement and text display independent of what is happening in the drawing. *CADmax 3D* does support the 640 by 480 VGA standard, but higher-resolution adapters are recommended. In fact, the manual warns that the system "is not intended to run at the low resolution provided by standard IBM VGA. You will find that the screen layout is poor in this configuration."

PROGRAM INTERFACE

To aid in daily usability, a shell option gives you up to 440K to run programs from within *CADmax 3D*. *CADmax 3D* itself is designed so that you don't need to take



your eyes off the screen. It's best to use a high-resolution mouse with the program. Primary menus appear at the top of the screen, message and status information across the bottom, and secondary menus and symbol selection areas on the left, with the remainder of the display reserved for drawing. The higher the resolution of the monitor, the higher the proportion of the screen area used for the display. The screen's status area has an outline of the drawing's boundaries with a box within it to indicate which part of the drawing the current screen is showing.

Selecting a menu option in the primary area will either activate a specific second-

ary menu or switch over to a different set of primary commands (the menus come with one 3-D and three 2-D menu pages). The secondary Detail menu provides you with all the pertinent subcommands and parameters, sometimes with many alternative preset selections available.

In most other CADD packages you pick a function and indicate what you want it to do. With *CADmax 3D*, the process is reversed. Without attempting to explain the rationale behind this system, let's just say that it involves a different way of thinking about the drawing and design process. However awkward at first, it becomes quite natural in time.

Commands are considered transparent when you can exit by touching the status display to go directly back into anything else you were doing without losing any work. When we last evaluated *CADmax 3D* (August 1988), there were only two

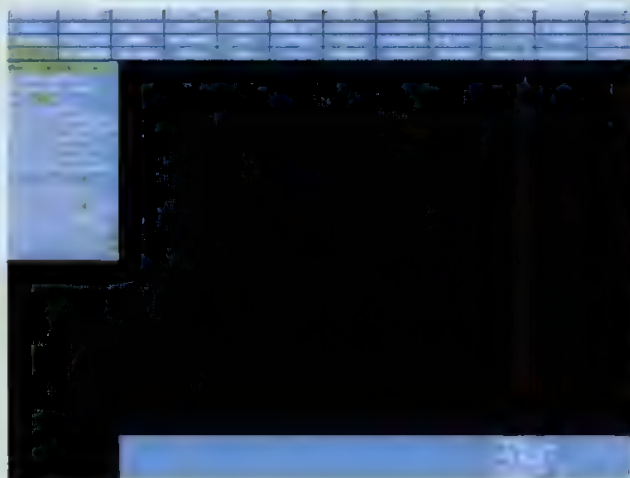
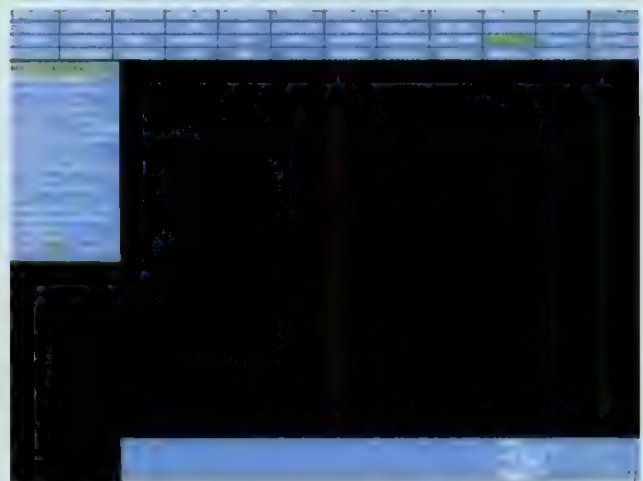
transparent functions: WINDOW (a display function that included panning, zooming, and other features), and SNAP (a function that included everything but quadrant snap). Since then, Vector Automation has modified about 30 percent of the commands to act transparently.

SOPHISTICATED TEXT HANDLING AND TOOLS

Text handling in *CADmax 3D* is extremely sophisticated, but with one flaw: there is only one available font for text. However, you can assign text attributes, one of them being the plotter font you'll use. If your hardware has several available fonts, you may plot by using any of them, but the text on the screen will not match the plotted output. Additionally, there is only a limited variation of the height, width, and spacing of text on-screen.

On the other hand, *CADmax 3D* can import any ASCII text file as text into the drawing. The imported text can be kept as

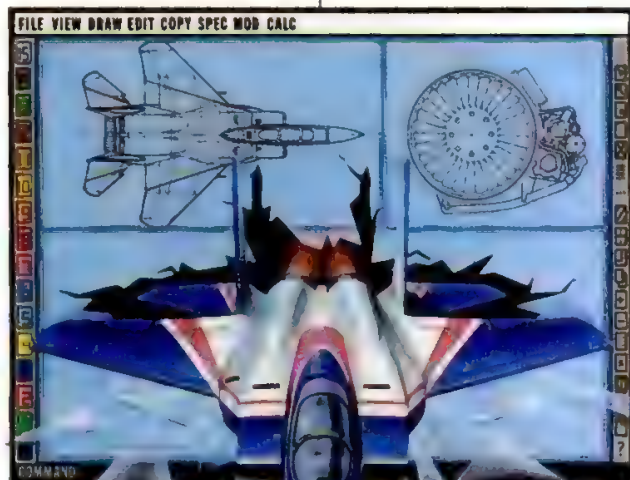
CADmax 3D's main functions appear across the top of the screen, and each is linked to a full pull-down menu. Here, the Show View menu has been selected, and a 3-D wireframe image is on-screen.



In this view, *CADmax 3D* is preparing the part for surfacing. One step in the process is hidden-line removal, which gives the object a realistic 3-D look.

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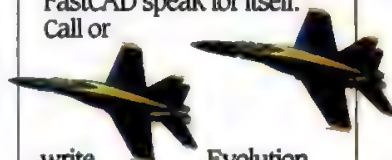
FastCAD's regen on an 8MHz XT is nearly twice as fast as AutoCAD's redraw on a 20MHz 386. FastCAD is also easier to learn and use than other market-leading micro CAD programs. In fact, FastCAD gives you the power to zoom, pan, change colors, layers and open, close or re-size windows—even while drawing a line, circle, box, polygon or other entity.



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a single entity or separated into individual lines. In either case, as well as with text generated within the drawing, all text is modified using *CADmax 3D*'s full-screen text editor. You can also modify the text with your favorite word processor. This system is worlds apart from the clunky old *AutoCAD* concept of text editing, and it's a pleasure to use.

Dimensioning the test drawing with *CADmax 3D* was a breeze. Everything you need is there and is easy to use and understand: tolerancing plus radial, linear, and all other dimensioning types and conditions. Not having used this program's dimensioning functions before, I found that dimensioning the entire drawing the first time took only about 8 minutes. If you are familiar with the program, it can be done in as little as 2 minutes. The really interesting feature, however, is that the 3-D model and all other views can be dimensioned directly—you don't have to extract 2-D views.

CADmax 3D's 2-D and 3-D databases are seamlessly integrated into one. You can add 2-D dimensions and text to any 3-D object in any view to produce a 2-D drawing. If the drawing changes, just modify the corresponding attached information.

For example, you can create a part in 2-D, then generate a 3-D wireframe from that drawing and use the automatic surfacing to generate the surface model. Or just as easily you could build the 3-D wireframe, automatically generate the solid, set up the orthographic views, and then annotate (with text, dimensions, notes) the 3-D views with 2-D data to get the completed 2-D drawing. It's as simple as that. There is no need to go through an extraction process to generate 2-D geometry.

CADmax 3D has a full complement of snaps and grids and a unique way of dealing with groups of entities. While most systems allow you to group entities only a single level deep, *CADmax 3D* goes well beyond that. Multiple groups plus additional entities can be gathered into families. Families can contain other families, reaching several layers deep. This allows you to develop an object-oriented group management system.

Line styles and text are handled in an unusual way. An Attribute function defines and modifies all attributes associated with a particular entity. There are three classes of attributes: 3-D Geometry, 2-D Geometry, and Text. For the Geometries, you can define the line style and color for

on-screen display, and you can define hardware-dependent line styles and pen numbers for plotter output.

TRUESURF TECHNOLOGY

With the *TrueSurf* add-on module, *CADmax 3D* becomes a very powerful production-oriented system, competing favorably with *Anvil-5000*, *Personal Designer*, and *Cadkey*.

Visualization is the key to being productive, and *TrueSurf* makes that visualization possible. *CADmax 3D* with *TrueSurf* offers dynamic rotation with hidden lines removed. You can watch an object change its orientation with hidden lines removed from view, which can eliminate confusing optical illusions. All views, including orthographics, can be shown in wireframe or hidden-line mode. Hidden lines can be displayed as dotted or made invisible.

TrueSurf is entirely automatic, interactive, editable and iterative. You need only identify what it is that you want surfaced, and *TrueSurf* does the rest. The resulting surfaces can be manipulated, edited, and deleted individually or in groups, just as with any other entity. No other system works this way.

You can go back and modify the wireframe or the surface and regenerate it. The mechanical part is easy to draw with *CADmax 3D*; even the projected circles and the planes with the holes in them are all handled automatically.

The surfacing algorithm the program uses acts as an integrity check. The resulting surfaces are good, and any continuity

problems—duplicate, erroneous, or non-contiguous surfaces—are identified and highlighted.

CADmax 3D could use more user-definable line types, more fonts, and an undo/redo control, and Vector Automation should consider ways to take advantage of more than just one mouse button. However, *CADmax* has improved considerably since our last evaluation. Although it is not yet one of the major players in the CADD market, the addition of *TrueSurf* makes it a top performer in dynamic 3-D view manipulation.

CADvance

by Rod Taylor

Surprisingly few growing pains have accompanied the development of ISICAD's *CADvance* from a 2-D system to a competent 3-D package. Competitively priced at \$2,995, both architectural and mechanical users will find many aspects of this program appealing.

CADvance not only lets you create 3-D wireframe and surfaced representations of your model and then derive 2-D projections from them, but it also builds groups and symbols, performs texturing operations, accesses up to 255 layers, plots drawings, and writes sophisticated macros for performing time-consuming or repetitive tasks. Additionally, you can generate and attach attributes such as material costs, serial numbers, assembly information, and vendor data to the various graphical objects in your model. These attributes allow you to form a direct link between your model and a relational database such as *dBASE*.

CADvance includes a hardware security device that must remain installed on your parallel port throughout the *CADvance* session. Be prepared to perform a cold boot if you install the security device after your system is already powered up. Another annoyance is the requirement of having any peripheral plugged into the security device remain powered up while *CADvance* is running.

CADVIEW IN OPERATION

CADvance provides a two-tiered command-menu structure along the right-hand side of the screen; commands may be selected by mouse, keyboard, or tablet. The menu structure is intuitive and well organized, and on-screen help is available.

The zoom, pan, and view commands

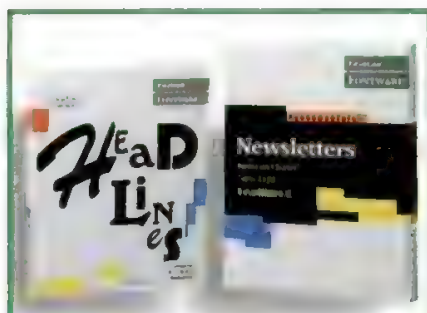
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CADmax 3D, Version 4.1
 Vector Automation,
 Village of Cross Keys,
 Baltimore, MD 21210;
 (800) 431-4347 (outside
 Md.), (301) 433-4200.
List Price: \$3,950;
TrueSurf extension,
 \$1,250.
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- ☐ **Turbo Tax 1989 Personal 1040 7.0**—Award winning tax preparation software with over 50 federal income tax forms & schedules. Includes a cross-referenced help system. 1989 World Class PC Award Winner . \$45.

- Borland International ... NCP**
1498 ☐ Turbo C 2.0 105.
4330 ☐ Turbo C Professional Pack 1.0 175.
5335 ☐ Turbo Pascal 5.5 105.
4332 ☐ Turbo Pascal Professional Pack 1.0. 175.
6242 ☐ Quattro Pro 1.0 289.
1514 ☐ Paradox 3.0 469.
- Brightbill-Roberts ... NCP**
5408 ☐ Hyperpad 1.0 89.
5843 ☐ Show Partner F/X 3.5 229.
- Broderbund ... CP**
1434 ☐ New Print Shop (NCP) 39.
1433 ☐ Memory Mate 3.01 (NCP) 45.
- ButtonWare ... NCP**
6419 ☐ PC-File 5.0 75.
- Caere ... NCP**
6004 ☐ Omnipage 386 2.0 599.
- Central Point ... NCP**
5039 ☐ PC Tools Deluxe 5.5 77.
5038 ☐ Copy II PC 5.0 27.

- Chipsoft ... NCP**
1663 ☐ TurboTax for 1989 Taxes 7.0 \$45.
☐ Individual States each 34.
- Chronos Software ... NCP**
4387 ☐ Who•What•When 1.09 119.
- Corel Systems ... NCP**
5506 ☐ Corel Draw 1.1 329.
- Crosstalk Communications ... NCP**
2908 ☐ Crosstalk XVI 3.7 109.
5611 ☐ Crosstalk for Windows 1.0 129.
- DacEasy ... NCP**
6398 ☐ Rapid Tax 1.0 45.
1748 ☐ DacEasy Accounting 4.0 89.
- Data Storm ... NCP**
4798 ☐ PROCOMM PLUS 1.1 52.
- Delrina Technology ... NCP**
4325 ☐ PerFORM 2.0 169.
- Delta Technology ... NCP**
5829 ☐ Direct Access 4.1 52.
- Digital Composition Systems ... NCP**
5876 ☐ db Publisher Report Maker 2.0 . 185.
- Dow Jones ... NCP**
5494 ☐ News/Retrieval Membership Pkg. 24.
- 5th Generation ... NCP**
5504 ☐ Brooklyn Bridge 3.0 79.
2762 ☐ Mace Utilities 1990 89.
3950 ☐ Fastback Plus 2.09 109.
- FormWorx ... NCP**
5810 ☐ FormWorx with Fill & File 2.5 85.
- Fox Software ... NCP**
6188 ☐ FoxPro 1.0 489.
2233 ☐ Foxbase Plus 2.1 199.
- Funk Software ... NCP**
2228 ☐ Sideways 3.21 42.
4479 ☐ Allways 1.0 85.
- Generic Software ... NCP**
2265 ☐ Generic CADD Level 3 1.13. 169.
- Great American Software ... NCP**
4880 ☐ One Write Plus Accounting Sys. 2.0 .179.
5825 ☐ Money Matters 1.0 55.
- Harvard Associates ... NCP**
2324 ☐ PC Logo 3.0 59.
- Hayes ... NCP**
2293 ☐ Smartcom II 3.0 89.



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- ☐ **PC-File 5.0**—The most friendly, comprehensive database available. It includes letter-writing with mail merge, business graphing, and a powerful report writer. It also works directly on dBase files \$75.

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2323	Hilgraeve ... NCP HyperACCESS/5 1.0 (DOS & OS/2) \$115.
6187	IBM ... NCP Storyboard Plus 2.0 239.
2408	Individual Software ... NCP Professor DOS 4.0 27.
6222	Resume Maker 1.0 29.
2426	Intuit ... NCP Quicken 3.0 39.
5191	Lord Publishing ... NCP Ronstadt's Financials 1.02 145.
5417	Lotus ... NCP 1-2-3 3.0 call
5653	1-2-3 2.2 call
5134	Magellan 1.0 149.
4131	Agenda 1.0 275.
2660	Freelance Plus 3.01 345.
4603	MECA ... NCP Andrew Tobias' Tax Cut for 1989 Taxes 45.
2798	Managing Your Money 6.0 119.
2775	Microcom ... NCP CarbonCopy Plus 5.1 (2 req.) 115.
2968	Micro Logic ... NCP Tornado 1.8 55.
2731	Microlytics ... NCP GOfer 2.0 (new version) 45.
2860	Microsoft ... NCP Learning DOS 2.0 35.
2899	Windows 286 2.1 69.
2904	Works 2.0 99.
2900	Windows 386 2.1 129.
2901	Word 5.0 209.
6195	Windows for Windows 329.
2856	Excel 2.1 (req. 80286/80386) call
6133	Excel for OS/2 1.0 339.
5188	QuickPascal 1.0 69.
2894	QuickBASIC 4.5 69.
2895	QuickC 2.0 69.
2853	C Compiler 5.1 299.
4925	Multisoft ... NCP PC-Kwik Power Pak 1.5 79.
4337	New England Software ... NCP GB-Stat 1.5 159.

2982	Nolo Press ... NCP WillMaker 3.0 \$35.
4928	Norton-Lambert ... NCP Close-Up Customer 3.0 135.
4929	Close-Up Support 3.0 165.
3142	Paperback Software ... NCP VP-Planner 3D 1.0 169.
5902	PC Globe ... NCP PC Globe 3.0 39.
5900	PC USA 1.0 39.
3126	Personics ... NCP SeeMORE 2.0 54.
4328	Look & Link 1.1 59.
3152	Peter Norton ... NCP Norton Commander 3.0 89.
3146	Advanced Utilities 4.5 89.
6397	The Norton Backup 1.0 89.
3221	Quarterdeck ... NCP Expanded Memory Mgr. 386 5.0 59.
3220	DESQView 2.25 79.
4586	DESQView 386 1.0 115.
6400	Manifest 1.0 39.
6422	QGRAM 1.0 49.



MECA ... NCP

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Software Publishing ... NCP

6289	Draw Partner 1.0 59.
3499	PFS:First Publisher 2.1 89.
3478	PFS:First Choice 3.02 105.
3496	Professional Write 2.11 149.
3493	Professional File 2.01 199.
3482	Harvard Graphics 2.13 339.

Symantec ... NCP

5383	Budget Express 1.0 99.
3427	Q&A Write 1.01 139.
3425	Q&A 3.0 229.
3431	Timeline 3.0 399.

Timeslips ... NCP

2987	Timeslips III 3.4 169.
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Timeworks ... NCP

6253	Publish-It! 1.1 115.
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TOPS ... NCP

3724	NetPrint 2.0 (share printers) 125.
3726	TOPS Network Bundle 3.0 159.
3720	Flashcard 2.1 (AppleTalk network card; 1 year warranty) 179.

Reference Software ... NCP

4396	Grammatik IV 1.0 52.
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Revolution Software ... NCP

4480	VGA Dimmer 2.01 (screen saver) 19.
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RightSoft ... NCP

4155	RightWriter 3.1 54.
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Samna ... NCP

5799	Ami Professional 1.0 319.
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Softlogic Solutions ... NCP

3546	Disk Optimizer 4.05 45.
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3542	Software Carousel 3.01 55.
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Softview ... NCP

3474	MacInTax for Windows (1989 taxes) 65.
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- ☐ Rapid Tax 1.0 for 1989 Taxes..... 45.

RECREATIONAL/EDUCATIONAL

- 1417 **Broderbund ... CP**
- 5701 ☐Where/Where? Carmen Sandiego? \$29.
- Electronic Arts ... NCP**
- 5798 ☐Ferrari Formula I..... 29.
- 4659 ☐Chessmaster 2100 (CP)..... 35.
- 5804 ☐Deluxe Paint II (Enhanced)..... 89.
- Microprose ... CP**
- 4454 ☐F-19 Stealth Fighter..... 39.
- 5823 ☐Red Storm Rising..... 39.
- Microsoft ... NCP**
- 2858 ☐Flight Simulator 4.0..... 39.
- Parlor Software ... CP**
- 3159 ☐Bridge Parlor 2.3..... 49.
- Sierra On-Line ... CP**
- 6023 ☐Leisure Suit Larry III..... 39.
- 5695 ☐Manhunter: San Francisco..... 33.
- 4456 ☐Police Quest II..... 39.
- 5106 ☐Space Quest III..... 36.
- 6022 ☐Colonel's Bequest..... 36.



Timeworks ... NCP

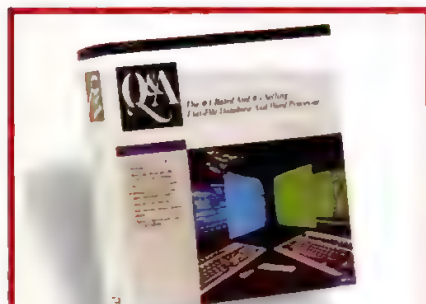
☐ Publish-It! 1.1—This complete desktop publishing program includes advanced page layout, graphics, word processing, and typesetting..... \$115.

- Traveling Software ... NCP**
- 4190 Battery Watch 2.0 (3 1/2" only)..... 35.
- 5179 ☐LapLink III 3.0..... 85.
- 3727 ☐DeskLink 2.2..... 99.
- True BASIC ... NCP**
- 3561 ☐True BASIC 2.1..... 52.
- Vericomp ... NCP**
- 3765 ☐SoftBytes 2.0..... 35.
- WordPerfect Corp. ... NCP**
- 3799 ☐WordPerfect Library 2.0..... 75.
- 3804 ☐WordPerfect 5.1..... 265.
- 3806 Additional Network Stations 5.1..... 169.
- WordStar USA ... NCP**
- 2825 ☐WordStar Prof. Release 5.5..... 229.
- 5000 ☐Upgrade to Release 5.5..... 89.
- Xerox ... NCP**
- 3812 ☐Ventura Publisher 2.0..... call
- XTREE ... NCP**
- 6161 ☐XTREE Pro Gold 1.3..... 75.
- XYQUEST ... NCP**
- 4393 ☐XyWrite III Plus 3.55..... 229.



Stone & Associates ... NCP

- ☐ 1st Math—Animated graphics teach addition, subtraction, & patterning. Ages 4-8... \$22.
- ☐ 2nd Math—Interactive tutorial and 7 games "teach" then "test" beginning addition through pre-calculus. Ages 7-16..... \$27.



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☐ Q&A 3.0—The top-rated, best-selling integrated database and word processor offers simple mail merge, detailed reporting, versatile word processing, advanced network support, and more..... \$229.

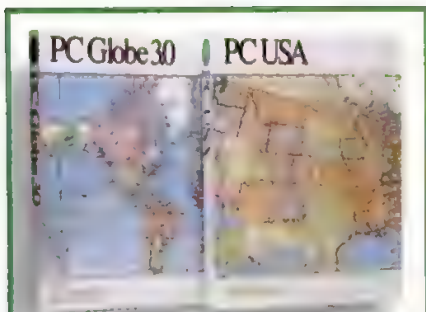
- Spectrum Holobyte ... NCP**
- 5993 ☐Welltris (Tetris sequel)..... 22.
- Spinnaker ... CP**
- 5580 ☐Sargon IV..... 32.
- Stone & Assoc. ... NCP**
- 3435 ☐My Letters, Numbers, Words (2 to 6) 22.
- 3438 ☐1st Math (ages 5 to 8)..... 22.
- 3439 ☐2nd Math (ages 7 to 16)..... 27.
- Sublogic ... NCP**
- 6190 ☐Air Transport Pilot..... 33.
- True BASIC, Inc. ... NCP**
- ☐ Kemeny/Kurtz Math Series: 10 titles..... each 45.

HARDWARE

Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

- AST Research ... 2 years**
- 1299 SixPakPlus 384k C/S/P..... 189.
- 4107 RAMpage Plus 286 512k..... 419.
- Brother International ... 1 year**
- 5787 HL-8e Laser Printer..... 1899.
- 5788 HL-8Ps PostScript Laser Printer... call
- 5786 Toner/Drum Kit..... 99.
- Central Point ... 1 year**
- 5042 Copy II PC Deluxe Option Board... 115.
- Compucable ... 2 years**
- 1604 2-Position switch box..... 25.
- 1605 3-Position switch box..... 35.
- Corvus ... 1 year**
- 6184 ReadyNet Starter Kit..... 319.
- 6183 ReadyNet Add-On Kit..... 165.
- Cuesta ... 1 year**
- 1608 Datasaver 400 Watt (power backup) 429.
- Curtis ... lifetime**
- 1690 Diamond Plus SP-1+..... 41.
- 1694 Emerald SP-2..... 36.
- 1707 Ruby SPF-2 (6 outlets)..... 55.
- 1708 Ruby-Plus SPF-2 Plus..... 65.
- We carry the full line of Curtis products.
- Diconix ... 1 year**
- 5655 150 Plus Printer (Parallel)..... 359.
- Epson ... 1 year**
- We are an authorized Epson Service Center.
- 1906 FX-850 (80 col., 264 cps, 9 pin)..... 369.
- 1904 FX-1050 (136 col., 264 cps, 9 pin)..... 479.
- 5183 LQ-510 (80 col., 180 cps, 24 pin)..... 349.
- 1930 LQ-850 (80 col., 264 cps, 24 pin)..... 549.
- 4117 LQ-950 (110 col., 220 cps, 24 pin)..... 569.
- 1917 LQ-1050 (136 col., 264 cps, 24 pin)..... 769.
- 4116 LQ-2550 (136 col., 333 cps, 24 pin)..... 989.
- 5184 LX-810 (80 col., 180 cps, 9 pin)..... 199.
- 1052 Printer-to-IBM cable (6 feet)..... 15.
- 5th Generation ... 1 year**
- 3952 Logical Connection 512k..... 529.
- Hayes ... 2 years**
- 2304 Smartmodem 1200..... 289.
- 2307 Smartmodem 2400..... 429.
- 2308 Smartmodem 2400B (w/Smartcom II) 429.
- Hercules ... 2 years**
- 2318 Graphics Card Plus..... 189.

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PC Globe ... NCP
☐ **PC USA 1.0**—Instant profiles on all 50 states and Puerto Rico, including maps, graphics, and data \$39.
☐ **PC Globe 3.0**—Provides profiles of 177 countries. Exports to many popular programs. 39.

- Intel ... 5 years**
 4696 2400B Internal Modem 159.
 2352 2400B Internal Modem 2 (for PS/2) 249.
 5119 2400 Baud External Modem 179.
 6420 2400EX MNP Modem 229.
 2346 Inboard 386/PC w/1 Meg (w/free Ami) 579.
 2339 Inboard 386/AT (req. inst. kit) 859.
 4266 Above Board Plus 512k 419.
 4267 Above Board Plus I/O 512k 449.
 5336 Above Board Plus 8 2 Meg 699.
 5342 Above Board Plus 8 I/O 2 Meg 739.
 4272 Above Board 2 Plus 512k 469.
 5396 Above Board MC 32 0k 359.
 4275 Connection Coprocessor 579.
 4857 Visual Edge 449.
MATH COPROCESSORS
 2370 80287-8 (for 8 MHz 80286 CPU's) . 199.
 2369 80287-10 (for PS/2 Models 50 & 60) 229.
 4750 80387SX (for 80386SX CPU's) . . . 309.
 2371 80387 (for 16 MHz 80386 CPU's) . . 349.
 2372 80387-20 (for 20 MHz 80386 CPU's) 399.
Kensington Microware ... 1 year
 2582 Masterpiece Plus 109.
 5697 Expert Mouse (Trackball for PS/2) . 115.
Key tronic ... 3 years
 4518 101 Plus Keyboard 99.
Kraft ... 5 years
 5801 New Game Adapter (2 game ports). 27.
 5800 3 button Thunder Joystick 29.
 5802 Trackball 69.
Logitech ... limited lifetime
 5464 Series 2 Mouse (C9 for PS/2's) . . . 69.
 5151 HiREZ Mouse (C9) 85.
 6029 Trackman (Trackball) serial 85. bus 89.
 4297 ScanMan Plus (hand scanner) . . . 185.
Micron Technology ... 2 years
 5818 Beyond 640 EMS Board 1 MB 369.
 5821 Beyond EX Extended Mem. Brd. 2 MB 599.
Microsoft ... lifetime
 2897 Mouse with Paintbrush 109.
 2898 Mouse with Windows 286 2.1 . . . 139.
MicroSpeed ... 1 year
 6007 PC-TRAC Trackball serial 75. bus 85.
 6010 FastTRAP 3D Trackball serial 99. bus 109.

- Mouse Systems ... lifetime**
 5845 White Mouse (bus or serial) \$69.
 5997 Trackball (1 yr. wrnty.) serial 75. bus 85.
 4306 PC Mouse II w/PC Paint+ 89.
NEC ... 2 years
 4799 Multisync 2A (VGA Monitor) 499.
 5085 Multisync 3D Monitor 689.
Orchid Technologies ... 4 years
 4690 ProDesigner VGA (800 x 600) 249.
PC Power & Cooling Sys. ... 1 yr
REPLACEMENT POWER SUPPLIES
 3202 Turbo Cool 150 (25° - 40° cooler) 129.
 3200 Silencer 150 (84% noise reduction) 115.
Practical Peripherals ... 5 years
 3101 1200 Baud Internal Modem 69.
 3100 1200 Baud External Modem (mini) . 77.
 3103 2400 Baud Internal Modem 139.
 3102 2400 Baud External Modem 179.
 5286 2400 Baud Int. MNP Modem (Lev. 5) 175.
 5285 2400 Baud Ext. MNP Modem (Lev. 5) 209.
 4542 2400 Baud Internal Modem for PS/2 . 229.



Intel ... 5 years
2400EX MNP Modem—MNP support allows error-free transmission as well as data compression providing 2400 bps throughput up to 4800 bps. Also supports Hayes compatible operation \$229.

- Safe Power Systems ... 2 years**
 4561 Safe 250W (standby power bkup) 249.
 4562 Safe 425W (standby power bkup) 369.
SOTA Technology ... 2 years
 5107 Floppy Drive Controller (SS/p) . . . 99.
 5111 SOTA 286i-12 (12 MHz accelerator) 269.
 5402 SOTA 386i-16 (16 MHz accelerator) 389.
Targus ... lifetime
 4899 Nylon Laptop carrying case 55.
 6037 Premier leather carrying case . . . 199.
TheComplete PC ... 2 years
 5598 TheComplete Half Pg. Scanner 400 189.
 4887 TheComplete FAX 9600 429.
 5140 TheComplete Page Scanner 549.
 5828 TheComplete Communicator 559.

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☒ **Network Bundle for DOS 3.0**—Allows you to quickly and easily share files, electronic mail and printers between your Apple Macintosh, IBM PC and/or Sun Workstation. Now includes Inbox EMail software \$159.

- Toshiba ... 1 year**
 3684 T1000 Laptop (80C88, 6.4 lbs.) . . . 669.
 4958 T1600 Laptop (12 MHz, 20 Meg) . . 3249.
Tripp Lite ... 2 years
 6201 Isobar 8 (8 outlets, 12 ft. cord) . . . 69.
 6019 LS 600 Line Stabilizer 85.
 6018 LC 1200 Line Conditioner 159.
Video 7 ... 7 years
 5883 1024i VGA (includes 512k) 289.
 4931 VRAM VGA 512k 449.

DRIVES

- DTC ... 1 year**
 6248 AT Floppy/Hard Drive Controller . . 129.
IOMEGA ... 1 year
 5116 Bernoulli II Single 44 Meg Internal 995.
 5117 Bernoulli II Dual 44 Meg External 1969.
 5113 44 Meg Cartridge Tripak (5 1/4") . . 249.
 2499 PC2 Card (controller required) . . . 169.
 2500 PC2B Card (bootable card) 229.



Microlytics ... NCP
☐ **GO! 2.0**—The original, affordable, simple, painless, quick, easy, and fast text-retrieval software package for IBM PC and compatible computers \$45.

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2935	40-60 Meg Int. Tape Drive for PS/2	379.
5502	83-152M Ext. Tape Drive.....	759.
5500	83-152M Int. Tape Drive.....	629.
6153	DC2120 Cartridge (5 pack).....	135.
5190	DC2000 Pre-formatted Cartridges ea.	35.

Pacific Rim ... 1 year

5010	1.2 Meg External.....	215.
5011	360k External 5 1/4" Drive.....	179.

Plus Development ... 2 years

3105	Hardcard 20 Meg (49 ms).....	529.
3106	Hardcard 40 Meg (28 ms).....	599.
6424	Hardcard II 80 Meg (19 ms).....	699.

Seagate ... 1 year

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Seagate drive for the IBM PC (not for
AT). Beta or VHS.

2285	20 Meg Internal Hard Drive ST225 (w/controller and cables, 65 ms) ..	289.
2286	30 Meg Internal Hard Drive ST238 (w/controller and cables, 65 ms) ..	299.
4554	40 Meg Int. HD ST251-1 (28 ms) ..	359.
2287	40 Meg Int. HD for PC ST251-1 (w/controller and cables, 28 ms) ..	429.
4624	80 Meg Int. HD ST4096 (28 ms) ..	619.



XTREE ... NCP
☒ **XTREE Pro Gold 1.3**—A treasure of advanced disk management features—Directory Tree Display, Application Menus, Archive Management, Autoview & Enhanced View. Single keystroke commands for all operations. \$75.

TEAC ... 1 year

4950	PC, XT 360k Drive (5 1/4")	79.
4951	720k Drive (specify XT or AT, 3 1/2") ..	79.
4670	1.44 Meg Drive for XT (3 1/2")	99.
4326	1.44 Meg Drive for AT (includes Basteck software utilities, 3 1/2" copy prot.) ..	119.

MISCELLANEOUS

Checkfree

6360	CheckFree Xpress	25.
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CompuServe

1676	CompuServe Information Service ..	24.
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Cables ... lifetime

1019	Smartmodem-to-AT cable (10 feet) ..	15.
5511	Right Angle Printer cable (6 feet) ..	15.
1050	Parallel Printer cable (15 feet) ..	19.

DISKS

All disks have a lifetime warranty.

5 1/4" DS/DD Disks (360k)

3291	Sony (10 disks per box)	\$12.
2789	Maxell MD2-D (10 disks per box) ..	13.
4192	Verbatim Datalife (10 disks per box) ..	13.

5 1/4" DS/HD Disks (1.2 Meg)

3770	Verbatim Datalife (10 disks per box) ..	19.
3292	Sony (10 disks per box)	19.



Intel ... 5 years Samna ... NCP
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Practical Peripherals ... 5 years
2400SA MNP—Fully supports error-free MNP Level 5 data transmission, giving you more confidence in your communications. Also supports Hayes compatible 2400 bps standard operation. \$209.

2790	Maxell MD2-HD (10 disks per box) ..	19.
	3 1/2" DS/DD Diskettes (720k)	
3297	Sony (10 disks per box)	14.
3772	Verbatim (10 disks per box)	15.
2792	Maxell (10 disks per box)	15.
	3 1/2" DS/HD Diskettes (1.44 Meg)	
3298	Sony (10 disks per box)	29.
3773	Verbatim (10 disks per box)	29.
2793	Maxell (10 disks per box)	29.

MEMORY

3248	256k DRAMs (120 nanosecond) ...	call
4366	1 Meg x 9 SIMMs (100 nanosecond) call	
5510	1 Meg x 9 SIMMs (80 nanosecond) call	
5746	1 Meg Chips (80 nanosecond)	call

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Note: Accounts on net terms pay actual shipping.

Continental US:

- For monitors, printers, Bernoulli Boxes, computers, hard drives, and power backups, pay actual charges. Call for UPS 2nd-Day & Next-Day-Air
- For all other items, add \$3 per order to cover UPS Shipping. For such items, we automatically use UPS 2nd-Day-Air at no extra charge if you are more than 2 days from us by UPS ground.

Hawaii:

- For monitors, printers, Bernoulli Boxes, computers, hard drives, and power backups, actual UPS Blue charge will be added. For all other items, add \$3 per order.

Alaska and outside Continental US:

- Call 603/446-3383 for information.



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Oh sure, we've heard the talk about how technology is going to

change everything. But, no matter how many megahertz you muscle into your micro, or how much resolution you ram into your rasters, or how many points per inch you output to print, you can still rely on us to deliver an irresistible combination of down-home prices and up-country personal service.

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It's important that we all keep our tootsies toasty as we stroll down the old stage road into the last decade of the 20th Century. So we're giving a free pair of genuine 100% wool PC Connection Sox to everyone who places an order of \$500 or more between now and March 31.



Enjoy safe sox all winter long with warm and toasty 100% wool PC Connection Sox. Offer not available to accounts on net terms. One per customer.

PC CONNECTION

are nested, which means that they can be invoked while any main menu command is still active. If you are trying to perform a group operation on two objects in your model but only one of them is currently on the screen, you simply Group Select the first object, perform a PAN operation, and then Group Select the second object. You can even perform multiple ZOOM/PAN/VIEW operations before selecting the second object. This feature is especially handy in the 3-D environment, where objects tend to become more complicated and difficult to select.

CADvance programs 23 frequently used commands to a set of quick keystroke combinations that allow you to alter the cursor's behavior, modify the digitizer's template parameters, and invoke macros. A keyboard template helps you to learn these keystrokes more quickly.

With CADvance's Macro Programming Language, you can write macros for the most monotonous tasks, like drawing a

threaded hole to a user-defined diameter, or for complicated tasks, such as generating a walk-through of your 3-D model. CADvance provides a full-screen editor for writing these macros.

CADvance does not support the concept of a current entity. This means that if you need to perform several operations (translate, rotate, copy, or change layers) on the same object, you must reselect that object prior to each operation. Additionally, CADvance does not offer pull-down menus, nor does it allow the screen to be split into multiple-view windows.

A 3-D WORLD

You enter the world of 3-D CADD in CADvance by selecting an option at the bottom of the 2-D menu screen, and immediately a few changes take place. The 3-D modeling environment comes complete with a 3-D coordinate system, reference

grid, and dynamic working plane.

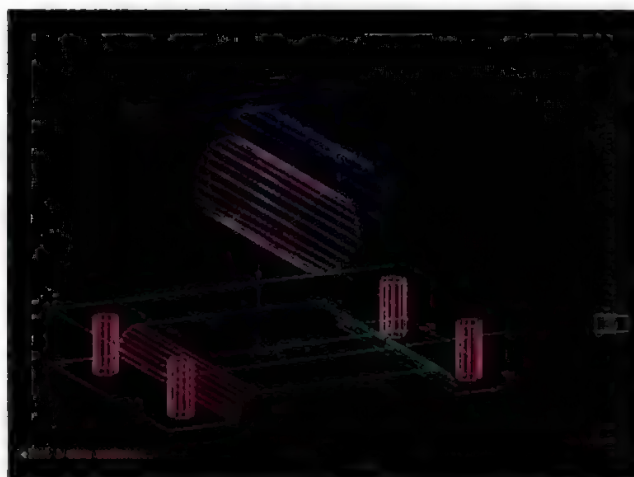
CADvance's 3-D facility is easy to use. Creating a polyline or wireframe entity is a snap. Simply move the working plane to the desired location in space and pick DRAW/LINE from the main menu. Polylines may have as many as 87 line segments. Select the menu option DRAW/FACE and you can create polygonal surfaces in 3-D space with ease. If you need a cylinder, simply bring in a circle from the 2-D area and extrude it using the UTIL/XTRD command. You can display your geometry either in orthogonal or perspective modes and have dynamic control of your viewing orientation as you move your mouse.

CADvance's 3-D facility also allows instancing, so you can create your 3-D model and extract 2-D orthogonal projections from it. Generating the mechanical drawing required for this review involved constructing the 3-D surfaced model, extracting the three orthogonal projections, and



Here is the design layout of the 3-D part as produced by CADvance. Note that in this view, text and dimensioning that are too small to read have been replaced by dots.

CADvance has arrived at the point just before hidden-line removal. From here, the program's HLR algorithm will attempt to render an unambiguous view of the part in shaded 3-D.



CADvance

SUITABILITY TO TASK

2-D drafting	
3-D modeling	
Architectural design	
Mechanical drafting	
Facilities management	

reading these projections into the 2-D drawing environment of the same model. The objects transferred from the 3-D to the 2-D arena were edited and dimensioned as needed to produce the finished result. Dimensioning the 2-D model was straightforward and took less than 40 minutes to complete.

In CADvance, a face (one side of a shape) is defined as either opaque or clear; that is, it is interpreted as a surface or as a window through a surface. This feature came in handy when preparing the test part drawing for hidden-line removal. The five holes were modeled as opaque cylinders with either end capped with a clear circular

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CIRCLE 287 ON READER SERVICE CARD



Takes the wait out of Windows!

face. All other surfaces were modeled as opaque. Since the circular faces were coplanar with the part's base and the cylindrical boss, *CADvance* correctly rendered them as the holes they were intended to be.

But if this package is to remain a viable contender in the 3-D CADD market, the few growing pains it is experiencing need to be addressed. Like many other 3-D packages, *CADvance* does not allow you to determine your model's volume, surface area, center of mass, moments of inertia, or weight. Although the 2-D portion allows you to determine the straight-line distance between two points, there is no built-in command in 3-D to do this.

Do you have a moderately large part model on which you want to perform hidden-line removal? That won't happen with this package. Even the simple mechanical part modeled in this review took some streamlining before *CADvance* could render it without returning an "internal limit

DataCAD, a 3-D CADD package that exists mainly for architectural use, was recently acquired by Cadkey, and it seems that the acquisition has breathed some new life into its sales and development.

Cadkey and *DataCAD* fit together remarkably well, especially considering that the products were developed independently and for entirely different markets. *DataCAD* (as well as *Cadkey*) has a heads-up keyboard-oriented user interface. All of its functions can be reached either with a mouse off the screen or by using keystroke shortcuts. For instance, the Equals key toggles you between wall mode and single-line mode. Hit "k" in the middle of a process and you will change the color of the entity you are creating. Similarly, "q" changes the linetype, Tab changes to the next layer, and "x" toggles the grid snap on.

The screen is divided into four areas: Menu, Status, Prompts and Messages, and the drawing area. The status area shows the current line style, layer, color, screen scale, selection set, and the state of most of the letter toggles: snap, wall/line, ortho, and whether the various drawing characteristics, including dimensions, are shown.

As an architectural program, *DataCAD* operates differently from other

DATA CAD: Of, By, and For Architects

by Brad Holtz



CADD systems. It is always in a draw line/wall mode. Everything else that happens within *DataCAD* is done as an

exceeded" error. And once it did work, the hidden-line-removal algorithm did not detect the intersection where the cylindrical section penetrated the wedge section. In order to get a realistic rendering, the intersection had to be calculated by hand and the 3-D model revised so that the surfaces comprising the boss terminated at that plane.

PRESENT SUPPORT AND FUTURE ADVANCES

In *CADvance*'s favor, all the documentation is well organized, easy to follow, and offers an adequate number of examples along the way. The index would be more helpful, however, if it were expanded and offered better cross-reference information. Tutorials covering the 2-D and 3-D aspects, the Macro Programming Language, and Instance Attributes are also included.

For an additional \$295, you can get a three-volume videotape tutorial. The 6

interruption of drawing lines/walls. (Walls are actually parallel surfaces

with height and elevation of the current z settings. Data is directly input only in the x and y dimensions. Z data is a parameter that is modified off the menus.) This makes drawing in *DataCAD* quite intuitive for people who have never used other CADD systems, but the transition from other programs to *DataCAD* is a little confusing.

FOR ARCHITECTS ONLY

Architects wrote *DataCAD*, and everything about it makes it clear that architects are its target audience. Everywhere you turn within *DataCAD* you



DataCAD lets you draw just as an architect does on paper. With the Overshoot option activated, lines go beyond their meeting point at intersections, making the drawing easier to read.

hours of instruction will expose you to everything you could possibly want to know about *CADvance*'s menu structure and basic commands.

Both IGES and .DXF file translators are available from ISICAD. The IGES translator lists for \$800 and the .DXF translator for \$150. While using the .DXF translator, a file being read into *CADvance* caused the entire computer screen to go blank. This problem occurs when the graphics card in the computer writing out the .DXF file is incompatible with the graphics card reading it in. Fortunately, the situation can be remedied easily.

Additionally, ISICAD recently announced that a joint agreement with Novell will soon have *CADvance* operating under *NetWare*.

Some of the problems *CADvance* is experiencing now are not unusual for packages making the transition from the 2-D to the 3-D CADD world. But all things con-

sidered, there's plenty to like about this package—most important, perhaps, is *CADvance*'s *dBASE* compatibility, which makes this an excellent choice for facilities managers.

DesignCAD 3-D

by Jim Boyce

At a modest \$399, *DesignCAD 3-D* is one of the least expensive 3-D modelers on the market. With *DesignCAD 2-D* priced at \$299, the two-package combination provides a good way for cost-conscious businesses to invest in a competent design and modeling system. Although you won't find *DesignCAD 2-D*'s feature set to be as full as those of some other packages, *DesignCAD 3-D* packs a great deal of model-

ing power. That plus the low cost make the trade-off in 2-D functionality worthwhile.

Both the 3-D and 2-D modules have menu-driven installation programs, so making the system run is an easy task. Unfortunately, the 3-D and 2-D programs won't coexist in the same directory peacefully; neither manual addresses the fact that when they are stored together in this way, you end up with garbled screens and other problems.

The interfaces offer both menu- and command-driven input. The screen menu is simple and easy to follow, but every selection of a menu option takes the cursor back to the top of the screen, causing a lot of unnecessary hand movement to bring the cursor back down.

One nice feature that both interfaces have is the ability to display absolute, relative, or polar coordinates in a variety of different units.

will find some little touch or nuance that only an architect would fully appreciate, and only an architect would find the lack of those particular touches a frustration. A good example is the overshoot of line intersections. Traditional-

able overshoot. With *DataCAD*, the lines can be made to appear as if they pass by and overshoot intersections with other lines. The drawings are easier to read, and architects are happy.

Text editing is done one line at a time. Text files can be imported, but each line becomes a separate entity.

The 3-D aspect of *DataCAD* is limited (even with the optional *DataCAD Modeler*). The tools are there to create the types of geometry an architect typically encounters in building, but only as a tool for visualization. The visualization tools, however, are excellent. Once a 3-D model is created, walk-throughs, automated fly-through and flybys, and movies can be created. Another optional program, the \$2,000 *DataCAD Velocity*, adds sophisticated anti-aliasing and ray tracing to your images, as well as texturing.

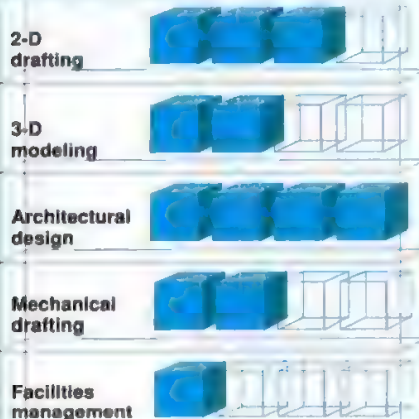
Architects will also appreciate the way *DataCAD*'s display zooms are handled. The zoom magnification is only possible in predefined steps (user-configurable). These steps generally correspond to common architectural scales. When the scale (zoom magnification) is set to .25 inch, it means that .25 inch measured on the screen corresponds to 1 inch in the real world. In other words, a .25-inch scale in *DataCAD* appears as the same physical size as a typical .25-inch scale drawing.

This is extremely important to architects, who rely on visual scale to understand space. This wonderful scaling system designed for architecture places restraints on those whose reliance on visual scale is not so important.

Though some CADD programs do a good job of providing features for every type of designer (and use that fact to justify their high price tag), there is a case to be made for task-specific software. For an architect making that case, *DataCAD* should be exhibit A.

DataCAD

SUITABILITY TO TASK



ly, architects have highlighted the endpoints of lines to make their drawings look and read better. You could always tell that a drawing came from a CADD system because the ends of lines met so perfectly. Engineers thought this was great, but many architects felt the drawings were less legible. *DataCAD* addresses that by providing a user-defin-

PC FACT-FILE

DataCAD,

Version 3.6

Cadkey Inc., 440
Oakland St.,
Manchester, CT
06040; (203) 647-
0220.

List Price: \$2,795;

DataCAD Modeler,
\$495; *DataCAD Velocity*, \$2,000.

Requires: 640K RAM, math coprocessor,
DOS 3.1 or later. Mouse or digitizing tablet
recommended.

In Short: *DataCAD* is a 3-D design and
drafting system designed for and by
architects. It has all the nice touches specific
to architectural design and is otherwise a full-
featured system. With its recent acquisition
by Cadkey, there should be some significant
advances in the near future.

CIRCLE 425 ON READER SERVICE CARD

ADDED FEATURES AND MISSING FUNCTIONS

Version 4.0 of *DesignCAD 2-D* includes many of the functions conspicuously absent in previous releases. The abilities to edit existing text, dimension arcs and circles, and even place text in an arc have been added. However, the package still lacks many of the point-snap and entity-creation aids that increase productivity. Another minor drawback is that the program works strictly from points—values for radius, diameter, and offset can't be keyed in but must be identified using points.

Hatching is another area that is difficult with *DesignCAD 2-D*. You can use lines or points to define a boundary, but to include arcs in a hatch boundary you must draw them as line segments. Then you must specify each line segment one by one. While *DesignCAD 2-D* offers a command to draw arcs as line segments, boundary-recognition algorithms have

commendable job of scaling, rotating, and slanting text using points.

DesignCAD 2-D includes .DXF import and export functions, as well as IGES importation. A special utility to convert HPGL files to *DesignCAD 2-D* files is also included in the package; it's a nice feature that makes data importation from a wide range of systems possible.

DesignCAD 2-D's block manipulation features are worth pointing out for their range of easy-to-use tools. As for the rest of its feature set, performance is quite satisfactory, and response time on all its functions is quick. Much of what this program lacks is compensated for by the outstanding features that are available in its 3-D counterpart.

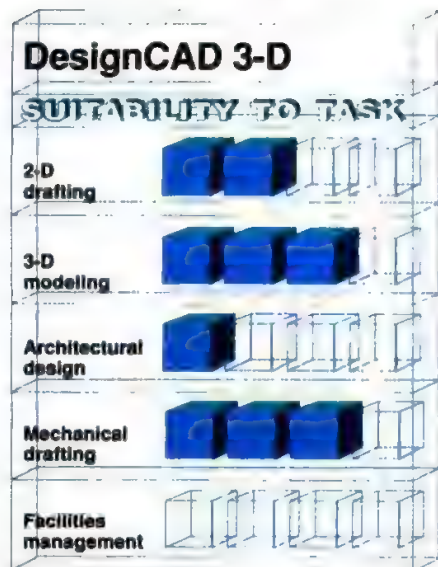
THE 3-D SURPRISE

DesignCAD 3-D is a relatively easy-to-use—but surprisingly powerful—surface

and solid modeler. Like most modelers, points are entered with x, y, and z values. A nice feature of *DesignCAD 3-D* is the mapping of z-depth to function keys F1 and F2; after setting a parameter value you can change z-depth simply by pressing one of the keys. This makes choosing three-dimensional points, drawing cubic solids, and selecting three-dimensional boundaries a breeze.

Functions for creating boxes, cones, cylinders, hemispheres, and spheres are included—simply pick a few points and select the function you want. Defining a workplane is not necessary with most of these functions; one of the points that you specify with each primitive is employed to determine the plane direction that is relative to the solid.

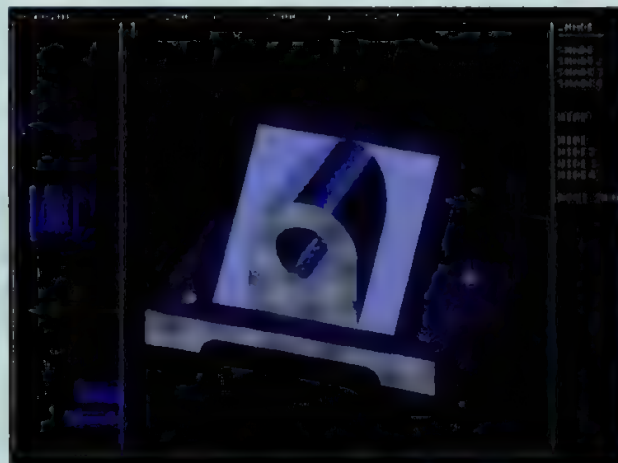
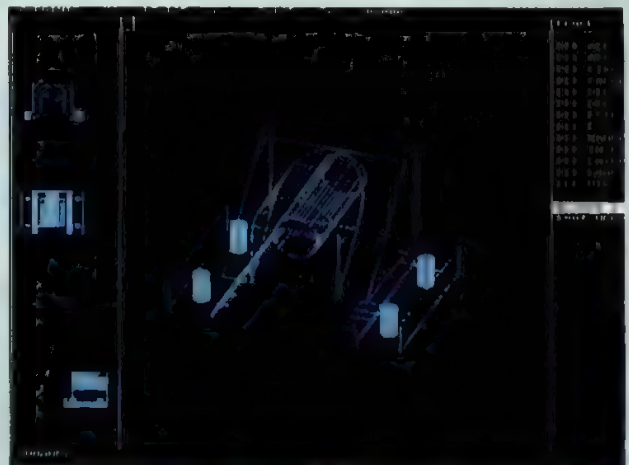
DesignCAD 3-D excels at complex surface modeling. Beyond the usual functions for extruding and making revolved surfaces, you can create spiraled surfaces and extrude them with varying thicknesses



been around for a long time, and to include one in *DesignCAD 2-D* would be a major step in the right direction.

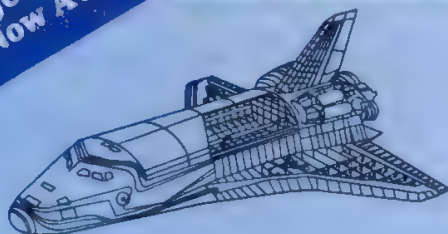
Dimensioning and text entry could also use some enhancement. While baseline, chain, and tolerance dimensioning have been added, *DesignCAD 2-D* still lacks finer control of arrowhead size and dimension offset distance. Additionally, drawing text can be entered only one line at a time and each new line requires reentering the text command. Since this means going back and forth between keyboard and mouse, creating a large block of text is not only time-consuming but frustrating as well. In its favor, *DesignCAD 2-D* does a

At just \$399, the three-dimensional facilities of *DesignCAD 3-D* are surprisingly complete. This isometric wireframe view is augmented by three other views—top, side, and front—on the left side of the screen.

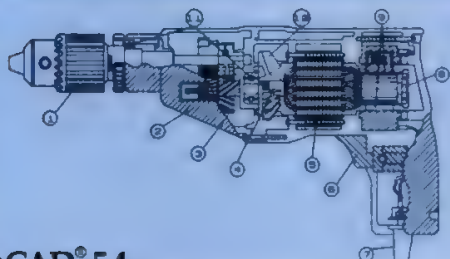


Spectacular shading is relatively easy to accomplish with *DesignCAD 3-D*'s full set of shading features. Here, the light source is positioned off to the left.

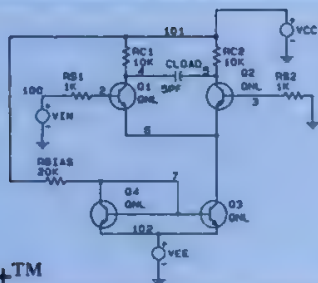
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GRAPHICS
3-D CADD



HIGH-END CADD
PROGRAMS: SUMMARY
OF FEATURES

Products listed in ascending price order

As high-end packages, all of these programs can handle CADD basics with ease. All allow both screen-oriented and keyboard-oriented data entry; they have absolute and relative rectangular and polar coordinates; they can left- and center-justify text, and can snap to a grid, the nearest point, an endpoint, a midpoint, the center of a circle, or another specified point. All let you select objects and groups of objects, and all have commands to mirror, rotate, and resize objects. They can join endpoints, and they can also break and trim lines, circles, and arcs.

List price

DRAWING COMMANDS

Line:

- Automatic polygon closing
- Automatic continuation of line
- Variable line width

Point

Circle:

- Center/radius
- Center/diameter
- 3-point circle

Curve:

- 3-point arc
- Ellipse
- Multipoint curve
- Spline curve
- Bezier curve

Polygon

Polyline

TEXT

- Right justification
- Auto-aligned
- Different fonts
- Different sizes
- Variable aspect ratio
- Can run along arc

DRAWING ASSISTANCE

Snap:

- Circle quadrant
- Intersection
- Perpendicular
- One-time

Grid:

- Variable size
- Variable aspect ratio
- Variable angle
- Isometric grid

EDITING COMMANDS

- Number of multiple windows
- Select last object
- Select by entity type
- Erase
- Unerase
- Animated movement
- Copy

☐ — Editor's Choice ☒ — Yes ☐ — No

3-D CAD

CONTINUES

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GRAPHICS

3-D CADD



HIGH-END CADD PROGRAMS: SUMMARY OF FEATURES

Products listed in ascending price order

EDITING COMMANDS

- Move
- Rectangular arrays
- Circular arrays
- Fill
- Extend
- Fillet
- Chamfer
- Segment line/arc
- Undo

DISPLAY CONTROLS

- Zoom
 - By magnification factor
 - By region
 - Restore original view
 - Dynamic zoom
- Pan
- Drag
- Display cursor coordinates
- Adjustable units
- Cursor icons
- Page display

DIMENSIONING

- Associative
- Linear
 - Horizontal
 - Vertical
 - At an angle
- Rotated text
- Baseline (stacked)
- Chained
- Diameter
- Radius
- Extension lines
- Line terminators
 - User-definable
- Tolerances
- Leaders

MEASURE

- Distance
- Area
- Perimeter

LINE TYPES

- Solid
- Dashed
- Center
- Phantom

SYMBOLS

- Menu-selectable
- Named
- Can be scaled

— Editor's Choice ■ —Yes ▴ —No

3-D CADD

CONTINUES

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Peter Roskam
Executive Director

GRAPHICS
3-D CAD/CAM



HIGH-END CADD PROGRAMS: SUMMARY OF FEATURES

Products listed in ascending price order

SYMBOLS

Can be rotated
Can be mirrored
Attributes

NONGRAPHICAL ATTRIBUTES

Editable

Can be output as a text file

PLOTTING CONTROLS

Variable sizing
Variable orientation
Plot part of drawing
By window
By layer
By attribute

Automatic scaling

MISCELLANEOUS FEATURES

Command-line interpreter
Command scripts
Programming language
Programmable screen menus
Programmable tablet menus
Freehand sketching
Function-key support
Imports and exports IGES files

3-D FEATURES

Polygons (with maximum number of sides)
Extrusions
Surfaces of revolution
Ruled surfaces
Tab surfaces
Coons patch surfaces
Vertex-defined surfaces
Hidden-line removal
Shaded images
Deflatable viewpoints
Derives 2-D images from 3-D models
Perspective viewing

COMPATIBILITY

NEC 1,024 by 768 spec
Compaq/Renaissance/Dell 1,024 x 768 spec
Paradise VGA
Video-7
Orchid

HELP

On-screen
Context-sensitive
Disk tutorial

☐ Editor's Choice ☐ Yes ☐ No

3-D CADD

ENDS

along the extrusion path. Boolean operations for uniting, subtracting, slicing, and intersecting solids are also provided in the package.

Different viewpoints, shadings, and perspectives are easy to generate. Shading requires issuing only a single command and takes but a few seconds with typical small models. As many as eight different light sources can be selected, and viewpoints can be easily changed by setting a few variables. The system models relatively quickly, although as the model becomes more complex there is a noticeable impact on speed, particularly when using Boolean transformations. Although the program will run on a PC without a math coprocessor, anything less than a 286 processor with a math chip would be impractical for any serious user.

DesignCAD 3-D's modeling is fairly straightforward. The sample model took just under an hour to complete. About half that time was spent in system calculation for subtracting cylinders to create the holes and in exporting the 2-D views. The 3-D module's performance wasn't perfect. Parts of each view exported to 2-D were missing, and not all hidden lines were removed as specified. However, the views can be cleaned up and used in the 2-D drawing.

Because of its rather limited 2-D editor, *DesignCAD 2-D* is not yet the ultimate drafting tool. But if you're interested in surface and solid modeling at a low cost, with design drafting and notation as secondary considerations, *DesignCAD 3-D* offers incredible bang for your buck. You simply will not find more power for less money.



FACT FILE

**DesignCAD 3-D,
Version 2.2**

American Small
Business Computers
Inc., 327 South Mill St.,
Plyor, OK 74361; (918)
825-4844.

List Price: \$299; solid
modeling package,
\$399.

Requires: 640K RAM, DOS 3.0 or later. Mouse
or digitizing tablet and Intel 80x87 math
coprocessor recommended.

In Short: *DesignCAD 3-D's* modeling abilities
match or exceed its more expensive
counterparts, and the lack of some features in the
2-D editor is easily forgiven, given its low cost and
the power of the 3-D modeler.

CIRCLE 843 ON READER SERVICE CARD



Drawbase 5000

by Jim Boyce

The \$4,995 price tag on CADwork's *Drawbase 5000* puts it in the upper price range of PC-based CADD software, but your money gets you a mature, complex, and powerful program that is similar to the ones running on high-end Unix platforms. Better yet, for all its complexity and power, *Drawbase 5000* is still easy to use and particularly well-suited for the architect who needs to track every aspect of design or for the facilities manager who must keep tabs on a building or a plant full of equipment.

The huge *Drawbase 5000* program is shipped on a total of 23 floppy disks and requires 15 subdirectories when installed. The well-written installation routine makes the process straightforward, but be prepared to give up a large chunk of your hard disk—at least 20MB is required for the complete system.

Drawbase could use some improvement in the monstrous AUTOEXEC.BAT file it generates. The installation program haphazardly appends lines to the file, ignoring any previous settings for path or system variables. The CONFIG.SYS file is the same, with file and buffer settings tacked on without consideration of existing settings.

The on-screen interface is simple, limited to a prompt line, a status line, and a point-selection menu. Although *Drawbase* supports a mouse, using one would not be viable even for limited tasks; a digitizer is a necessity for choosing the majority of commands. The digitizer menu is well organized, and the overlay is color-coded to make finding each of its 500-plus possible selections a little easier. Various option selection boxes let you pop up a window for setting environment parameters and options.

A FULL RANGE OF FUNCTIONS

Drawbase's maturity is displayed in its range of functions. It is one of the few PC-based programs to see the benefit of construction lines—a feature found on the majority of workstation-based systems. A number of options allow you to create construction lines and arcs by employing various combinations of points, tangencies, angles, and existing entities. An excellent set of point-selection functions makes drawing a breeze.

Cross-hatching is a wonderfully simple

process because of *Drawbase's* boundary-recognition algorithms. Just put a point inside your boundary and place points inside any voids and there's your hatch! Selecting entities by window is unnecessary, and there is no worrying about whether you've broken intersecting lines. If you need to modify the hatch, or change the pattern or line type, there's no need to erase and redefine the hatch—just set the parameters you want and the Modify Hatch command up-

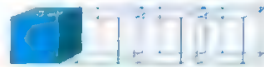
Drawbase 5000

SUITABILITY-TO-TASK

2-D
drafting



3-D
modeling



Architectural
design



Mechanical
drafting



Facilities
management



dates it. Text can be selected as a hole in hatching and is automatically hatched around.

Breaking and trimming lines is another area where *Drawbase* shows unexpected simplicity. If you want to trim a line or arc where it intersects another entity, just select the portion to be deleted. There's no need to identify which entity to use as a trimming boundary or where the break-points are. *Drawbase 5000* is capable of recognizing those things automatically.

USER-DEFINABLE PARAMETERS

A complete set of text manipulation and dimensioning commands covers a wide range of possibilities. A number of user-definable parameters let you control text and dimension placement, size, and orientation. Text can also be boxed automatically with a balloon; it can be read from disk or typed in on the keyboard and it is easily edited. One of the program's very few quirks is that you must make a selection from the digitizing tablet each time you want to enter a new line of text in a multi-line block. Moving between tablet and keyboard is sometimes bothersome and

Run Your 80287 at 20 MHz!

Since 1982, MicroWay has been providing state-of-the-art numerics for the IBM-PC/AT, and compatibles. We are now pleased to introduce a new 20 MHz 80287 — the 287Turbo-20™. It runs twice as fast as our 10 MHz 287Turbo and is 80387 compatible. Because it employs a low power CMOS part, it can be used in portables and laptops. The 287Turbo-20 is based on a MicroWay-qualified Intel 80C287A that has been rewired, decoupled and reclocked to run asynchronously in an ordinary 80287 socket. It is ideal for today's 16- and 20 MHz machines. The 287Turbo-20 will dramatically improve the performance of an old AT, especially in applications where elementary and transcendental functions are heavily used.

We are also pleased to introduce new releases of two MicroWay classics — MatrixPak and 87FFT. These products, along with 387Basic, make it possible to generate real

mode code with a numerics efficiency that approaches 100%, without resorting to global optimization or assembly language. *These products are important because most programmers are still using real mode tools in their 386 systems, despite the advantages of the 386's 32 bit architecture.* The tools solve problems with the Intel real mode segmented architecture which hinders the performance of numerics coprocessors. They employ algorithms that cannot be easily implemented by general purpose compilers.

For example, if you compare programs that multiply matrices, you will discover that the huge model code produced by an excellent product, such as Microsoft FORTRAN, runs 2 to 4 times slower than the MatrixPak matrix multiply. MatrixPak employs a unique storage algorithm in conjunction with runtime binding to produce its results. The same technique is

employed by 87FFT, which also employs an "in core" solver that makes it possible to perform FFTs on arrays stored on disk.

387Basic is another MicroWay classic. PC Magazine's November, 1989 review of the current BASICs says,

"387BASIC is the product to use if you have a program which is numeric intensive...the programs ran faster than any of the other BASICs and generated more accurate results."

Naturally, we still sell our NDP Fortran, C, and Pascal 386 compilers and the coprocessors you need to make them perform. PC users have been relying on MicroWay for 8 years to solve their numerics problems. If you have a question about which coprocessor is best suited to your application, call or write for our brochure, "The State of PC Numerics in 1990" by Stephen S. Fried.

287 Tools

87BASIC™ — Our 16-bit MS source compatible compiler is specifically designed to take advantage of the 8087 and introduces numeric register variables to produce the fastest 8087 code on the market. \$99

387BASIC™ — Is an upgraded version of 87Basic which generates code that takes specific advantage of the 80387 and 80387SX. For "floating-point and other complicated mathematical calculations, you'll appreciate the extraordinary speed with which 387BASIC handles these processes". PC Magazine 10/31/89. . . \$149

MATRIXPAK™ — Library of 30 routines written in assembly language which manipulates dense matrices and utilizes the 8087/80287 math chip for optimum speed. The matrix size is limited only by the amount of contiguous RAM space in the computer. There can be any number of rows in a matrix, each containing up to 64K per row. Callable from most 16 bit compilers. \$99

87SFL™ — A library of 140 mathematical functions including elementary, trigonometric, hyperbolic, error, Bessel, Airy, Kelvin, probability, Weierstrass, Gamma, Psi, and Beta functions, plus exponential, elliptic, Fresnel and Dawson Integrals and the polynomials of Legendre through Chebyshev, plus 17 random number generators. Callable from most 16 bit compilers. \$149

87FFT™ — Written in assembly language, 87FFT performs single and two dimensional Forward and Inverse FFTs on real and complex arrays. Allows single and double precision data types. Also performs convolutions, auto correlations, hamming, complex vector multiplication, and complex to radial conversions. \$149

OBJ→ASM™ — Multipass object module translator and disassembler that disassembles OBJ files (not COM or EXE files). Adds labels and cross references to the output which may be directed to the screen, printer or disk file. The generated listing is complete with data and code segments, and ASSUME statements. . . . \$149

386 Compilers

NDP FORTRAN-386™, NDP C-386™

NDP PASCAL-386™ — MicroWay's compilers generate globally optimized, mainframe quality code that runs on the 386 or 486 in protected mode under UNIX, XENIX or Phar Lap extended DOS. The compilers address 4 gigabytes of memory while supporting the 80287, 80387 and Weitek coprocessors. They all come with a library of over 70 device-independent graphics, keyboard and sound routines. Applications can mix code from all three compilers and assembly language. The DOS versions allow the user to write his own numeric error handlers and interface 386 real mode programs from protected mode. The VM versions use Phar Lap's Virtual Memory Manager to run programs which exceed the size of your system memory. NDP Fortran-386 is a full FORTRAN 77 that is 99% VMS compatible, with FORTRAN 66, BSD 4.2, and DOD extensions. NDP C-386 is a full K&R C with both MS and ANSI extensions. It is 100% compatible with UNIX C and is substantially faster than the C which comes with UNIX. NDP Pascal-386 is a full ANSI/IEEE Pascal, with extensions from C and BSD 4.2 Pascal.

DOS versions (require Phar Lap Tools) . . . \$595
VM version (requires VMM) \$695
UNIX/XENIX versions \$795
Phar Lap Development Tools \$495
Phar Lap Memory Manager (VMM) . . . \$295

NEW! AT Accelerator

NUMBER SMASHER-386™ — A full-sized card that replaces the 80286 microprocessor on your IBM AT or compatible motherboard with an 80386 that runs at 16, 25, or 33 MHz. It runs numerically intensive applications up to a factor of 60 times faster, while maintaining full hardware and software compatibility, and runs all 386 applications. Includes sockets to optionally add up to 8 megabytes of 32-bit memory, an Intel 80387 or Weitek numeric coprocessor, and 64K or 256K of high speed cache memory. Can be enhanced in increments. from \$895

NEW! 287Turbo-20™

287Turbo-20™ — This coprocessor board runs a specially qualified Intel CMOS 80287 at 20 MHz regardless of your 286's speed. . . \$450

Intel Math Coprocessors

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80287-8 . . . \$195	80287-10 . . . \$220
80387-16 . . . \$330	80387-16SX . . \$310
80387-20 . . . \$375	80387-25 . . . \$460
80C287A . . . \$280	80387-33 . . . \$550

386 Tools

387/NDP FFT™ — The fastest running FFTs on a PC! 40 hand-coded routines that handle 1 and 2 dimensional data arrays. Includes an in core solver that spills to disk for arrays too large to fit in memory. Also includes support for Weitek 3167. NDP or 80x87 version \$250

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NDP NAG™ — The NAG Workstation Library is a subset of the NAG mainframe libraries. It contains 268 commonly used routines to solve differential equations and eigenvalue problems, perform matrix operations, fit curves, do statistics and regression analysis, generate random numbers and compute special functions and integrals . . . \$895

MicroWay

World Leader in PC Numerics

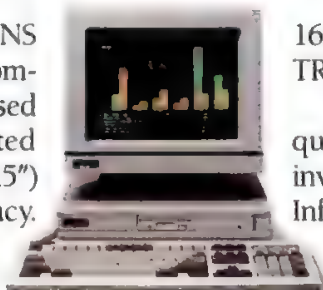
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HANDOK
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made in Korea.

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generally slows down text entry.

Drawbase's easy-to-use facilities for drawing walls, automatic clipping of door and window openings, and placement of symbols make it everything *AutoCAD* was meant to be. These features alone could easily make *Drawbase* the best choice of PC-based CADD software for architects and facilities planners.

DATABASE MAGIC

Drawbase's power is not just in its drawing capabilities, but in the things you can do with what you draw. Its integrated database capabilities stand well above the competition, and this is where *Drawbase* lends itself most to facilities management and architectural design. Building and equipment costs are just two examples of data that can be tracked and evaluated within *Drawbase* or conveniently exported to programs such as *Lotus 1-2-3* or *dBASE*. Its space-utilization functions offer a handy yet sophisticated set of tools for

tracking lease income, building usage, and utilities.

Drawbase includes integrated three-dimensional modeling and viewing. The 3-D data types are limited to extrusions and planes, further reinforcing the fact that *Drawbase* is meant for architectural design, not solid modeling or complex surface modeling. Its method of creating 3-D data by elevating (rotating in 3-D) 2-D profiles and extruding them takes a little rethinking for someone who is experienced with other types of 3-D modeling, but it works very well for architectural drawings.

Even though *Drawbase* includes geometric-tolerancing symbols and would work well for 2-D design in other disciplines like mechanical engineering, it's not suited to the types of 3-D modeling typically performed in those disciplines. This is primarily because planes must be con-

structed of single, closed profiles with no circles or voids inside the outer profile, making it impossible to put a hole in a surface. However, the hole can be simulated by drawing it as part of the outer boundary,



FACT FILE

Drawbase 5000,

Version 1.00

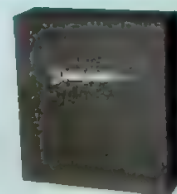
CADworks Inc., 222 Third St., #1320, Cambridge, MA 02142; (800) 866-4CAD, (617) 868-6003.

List Price: \$4,995; shading module, \$495.

Requires: 640K RAM, Intel 80x87 math coprocessor, parallel port for hardware lock, DOS 3.1 or later. Mouse or digitizing tablet recommended.

In Short: *Drawbase 5000's* advanced database features and excellent graphics-editing features make it state-of-the-art in PC-based CADD for architects and facilities managers. Copy protected.

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In this screen, *Drawbase 5000's* *Shade* program displays the 3-D test part as a wireframe. This package is best suited for architectural work; creating a mechanical part like the one shown here requires extra steps.

Here are the results of trying *Drawbase 5000's* hidden-line removal on the 3-D part. You can see that some of the surfaces have disappeared during the process.



much like cutting a kerf down to the hole to make it a continuous part of the boundary.

Unlike traditional methods of 3-D modeling, there are no means for rotating the coordinate system to draw in 3-D. Essentially, everything must be drawn in planes, then elevated and extruded into 3-D position. For that reason the test model could only be approximated—some of the faces are missing, and the holes are not recognized as voids. But *Drawbase's* 3-D capability is fine for extruding walls and creating the other comparatively simple surfaces found in architectural work.

Shading in *Drawbase* is handled via an add-on program appropriately called *Shade* (\$495). While the documentation for *Drawbase* includes two thick volumes, the *Shade* documentation seems a bit thin, containing only 20 pages. Aside from the drawback that *Shade* works externally from *Drawbase*, the menu does not support the mouse or digitizer. Selections are made by the cursor keys or by typing the first letter of the command. For light-source shading, *Shade* uses different hues and saturation to achieve the effect of depth, shadow, and reflection. With a 16-color VGA card, the entire image is one color, with no gradations of hue to simulate those characteristics. With a 256-color card, however, shading is very good.

For data portability, *Drawbase* provides a full complement of data translators including .DXF input and output, Arplan format translation, HPGL input/output,

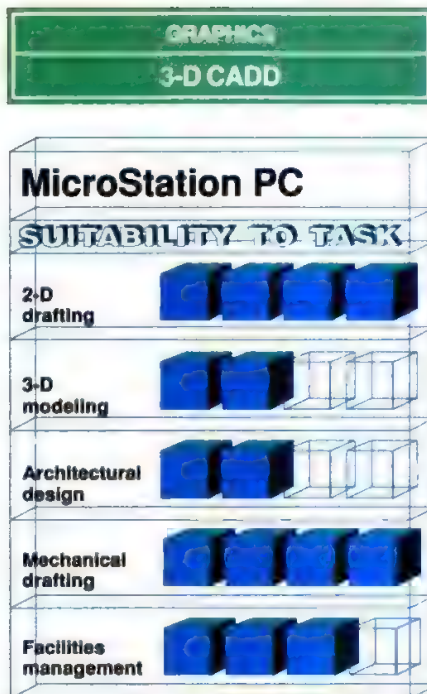
Lotus/Symphony output, comma-delimited ASCII output, and ASCII text input.

Drawbase 5000 is not for everyone. Less expensive programs are better choices for anyone who needs a 3-D modeler for mechanical design and detailing or related disciplines. *Drawbase's* powerful database functions and other facilities are geared primarily toward architects or facilities planners who need much more than just a CADD drawing. If you happen to fall into one of these categories, *Drawbase 5000* is state-of-the-art and worthy of your consideration.

MicroStation PC

by Brad Holtz

Intergraph's \$3,300 *MicroStation PC* is a powerful design system that excels in situations where several people are working on a project together. It has its roots in Intergraph's *IGDS* (Interactive Graphic Design System), a product that runs on big VAXes. *MicroStation PC* is essentially a



superset of *IGDS*, and the PC version will soon have a full graphical user interface like that of its minicomputer counterpart.

Several concepts in *MicroStation PC*

differ from most other systems. For instance, in *MicroStation PC* you perform some operations on individual entities or graphic groups. Graphic groups are specific groups of entities that were either created together or gathered together with special commands. An entity may only belong to one graphic group.

Other operations are performed on groups of entities, fences, and working sets. A fenced area may be a simple rectangle (or volume, in 3-D) or any area enclosed within a complex polygon. With all fences you have the option of choosing items entirely within a fence or partially within the fence, or of clipping the items at the fence boundary. There is no way to save a particular fence—it remains active until you redefine it. If you need to deal with more than one fenced area at a time, you can add entities, graphic groups, and other fences to the working set.

Rather than having you select a function and then choose the objects on which to perform that operation, *MicroStation PC* has a separate set of functions to use

FastCAD, Version 2.28, a \$2,295 package from Evolution Computing, is an impressive 2-D PC CADD system that consistently posts the fastest benchmark test results overall. If it's 3-D modeling you need, *FastCAD* is not the ticket. However, with its unparalleled speed and extraordinary ease-of-use, *FastCAD* is a great foundation for a 3-D system, and the vendor claims that work toward this goal is almost complete. But until then . . .

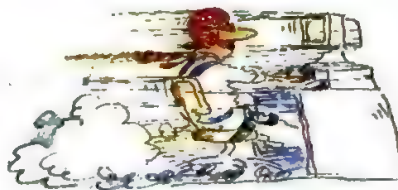
Don't blink when you run *FastCAD* for the first time. In less than a second the *FastCAD* screen appears, and you're ready to go. Four mouse clicks are required to load any drawing, and regardless of complexity, the drawing is displayed almost instantly. Virtually the entire screen is available for the graphics display. A single row or column around each edge of the screen is reserved for the pull-down menu titles, icons, and a command-line interface that is rarely used.

MORE STEPS, LESS TIME

FastCAD can't compete with other systems in terms of numbers of commands. In fact, *FastCAD's* approach to CADD parallels the RISC (Reduced Instruction Set Computer) approach to

FASTCAD: When Speed Is All That Matters

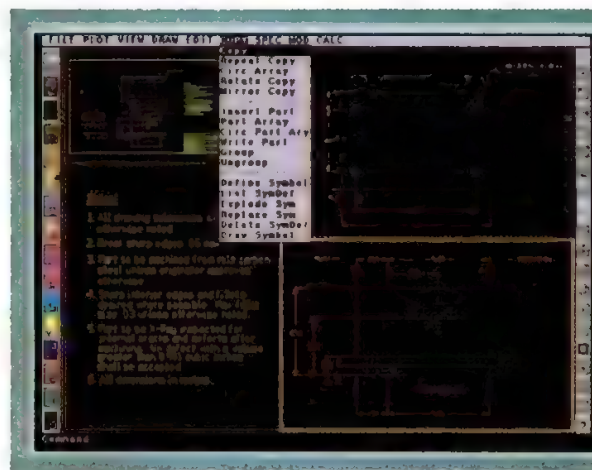
by Will Schloter



computer design. The *FastCAD* program doesn't try to provide you with every feature under the sun; it just per-

forms basic functions very quickly and efficiently and allows you to customize the system to your satisfaction. Sometimes you might have to take some extra steps in order to complete a task, but the overall speed of the system usually makes these extra steps faster in the end.

You aren't held up by such commonly performed operations as loading or saving a file, refreshing the screen, zoom and pan, or changing views. All of these things happen with lightning speed. In addition, operations and settings such as pan, zoom, color, layer,



Part of what makes *FastCAD* so fast is its up-front, easy-to-understand menu and windowing system. There are no wasted mouse clicks with this program.

depending on whether you are working with an entity/graphic group or a fence/working set. Most functions are available to either type but require different commands. While these are very complex and powerful tools, the need for a completely separate set of commands seems cumbersome and outdated.

Tablet menus are more or less shunned in *MicroStation PC* in favor of icon-like on-screen graphic tutorials (similar to *AutoCAD*'s dialog boxes) and lots of on-screen menus. In order to create the test drawing, most commands were selected from a screen menu, with modifications and distances occasionally entered from the keyboard.

A DIFFERENT WAY OF ENTERING DATA

Data entry in *MicroStation PC* is also a little different from other systems. Four buttons are activated on tablets used with the program, while three buttons are used on a mouse. These functions are given the names Data, Tentative, and Reset (and Command for tablets). Data and Reset act

GRAPHICS 3-D CADD

FACT FILE EDITOR'S CHOICE

MicroStation PC, Version 3.0
Intergraph Corp.,
Huntsville, AL 35894-0001; (800) 345-4856 (outside Ala.), (800) 345-0218 (in Ala.).
List Price: \$3,300.
Requires: 640K RAM, 20MB hard disk, communications port, one parallel port, math coprocessor, DOS 3.0 or later. Mouse or digitizing tablet recommended.
In Short: An extremely potent design and drafting system with the best information management in the industry. This package is best for organizations where more than one person works on a project at the same time. Copy protected.

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similarly to any other system's pick and reset buttons. The Command button is used with the tablet to distinguish between a

command and a digitized point. By choosing either a Data button or Command button you indicate which type of input you are sending to the program.

The Tentative button stands apart from features found in other systems. Select Tentative and the system will snap to and highlight (simultaneously in all displayed views) the first of the possible snap-to points or entities it sees in the database. If that's what you want, then just press the Data button to confirm. If not, hit the Tentative button again until the item you are looking for is highlighted. You will immediately recognize the importance of this feature if you have ever tried to select one of several lines lying on top of each other in a particular view. Tentative is also used for locating intersection points and offset points.

MicroStation PC's reference files have always had a leg up on the competition. A reference file is a drawing attached to the current drawing. This type of file can be scaled, rotated, clipped, and placed anywhere in the current drawing. Any

grid specifications, font, fill pattern, help, and view manipulation are always instantly available via the on-screen icons without the hassle of interrupting your current operation.



As a CADD system, *FastCAD* is one of the easiest to learn. Included in the 600-page manual are 14 well-written tutorials that help teach the system from the ground up. On-line help, though not context-sensitive, is always

available. Creating a 2-D representation of the test drawing proved to be no challenge to *FastCAD* with one major exception—dimensioning. *FastCAD* provides a very limited selection of dimension types: horizontal, vertical, parallel, and angular dimensions are the only ones provided. All other types have to be created by hand and are non-associative.

EASY CUSTOMIZATION

The ability to fully customize *FastCAD* is one of the program's main strengths. An External Interface (XP) Toolkit, a \$150 option, gives third-party software developers an assembly language interface to integrate custom applications seamlessly. On a more simple level, any user, whether he is a novice or an expert, can use an ASCII text editor in order to change the standard menu files as well as to create *FastCAD* macro and script files.

The upcoming 3-D version of *FastCAD* should have the same high level of performance and ease-of-use as the 2-D version while adding true 3-D entities. *FastCAD*'s interactive windows will play an even more important role in the 3-D system by allowing views to be created and manipulated on-the-fly

without interrupting the current operation.

FastCAD is designed to be a high-performance, general-purpose tool. Therefore, customization is required to make it more than just a very fast sketch pad. *FastCAD* is an excellent tool for the occasional user who needs an easy-to-use 2-D system, especially if that user is in a big hurry.

FACT FILE

FastCAD, Version 2.28
Evolution
Computing, 437 S.
48th St., #106,
Tempe, AZ 85281;
(602) 967-8633.
List Price: \$2,295.

Requires: 512K RAM, math coprocessor, DOS 2.0 or later. Mouse or digitizing tablet recommended.
In Short: Almost certainly the fastest and easiest-to-use 2-D PC CADD package available. With an intuitive and effective interface no matter what level of user you are, entry-level or expert, you can be up and running in a matter of minutes. The External Interface Toolkit makes third-party customization possible.

CIRCLE 424 ON READER SERVICE CARD

changes made to the attached drawing automatically appear in the current drawing when the system is updated.

Reference files are critically important to the future of CADD as a workgroup tool, and their presence in *MicroStation PC* gives the package a huge head start in that arena. Suppose you are developing a reflected ceiling plan and you designate the underlying floor plan as an attached file; now imagine that someone else is simultaneously working on the same floor plan. That way if a wall is moved, you'll see it happen on your screen when you update the reference file (in some cases this happens almost simultaneously).

You can also have a file reference.

Take an area you wish to detail, call it in as a reference file, make it a different scale, and clip it. Voilà! You have an instant self-updating detailed drawing sheet.

MICROSTATION PC IN 3-D

MicroStation PC's 3-D facilities are limited but powerful. 3-D entities include any 2-D entities defined in space, flat planes, cones, cylinders, and surfaces of projection and revolution. It lacks primitives for spheres, complex surfaces such as Coons patches and ruled surfaces, solids, and Boolean operators. But the entities that *MicroStation PC* does provide are fully

implemented, integrated, and usable.

Creating the test part was not difficult, once two important concepts were understood. First, to create a fully surfaced extrusion rather than a hollow box-type extrusion, you must create a shape out of existing entities. Line strings must be dropped back to lines before you do this.

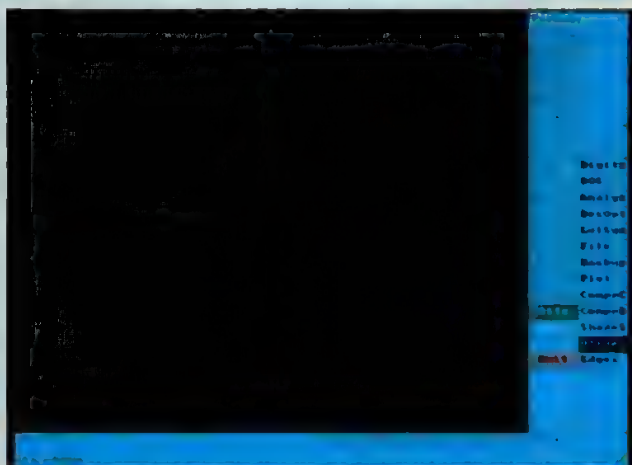
A multitude of third-party, application-specific software can turn *MicroStation PC* into the solution for many disciplines.

Second, and more critical, the view in which you select the shape for projection affects that projection.

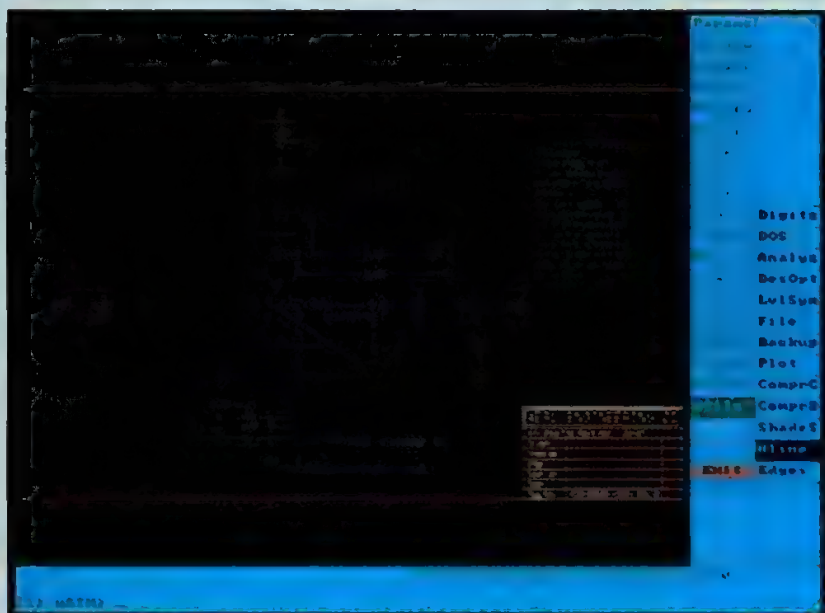
Once this was absorbed, producing the 3-D model became a trivial exercise. Two points should be made, however. First, you cannot perform a fillet if the line left after the fillet has a zero length. And since there are no Boolean operations, you cannot construct the intersection between the inclined plane and the cylindrical front piece. *MicroStation PC* will perform the surface shading correctly and the hidden-line removal shows the resulting intersection, but there is no easy way to generate the intersection as part of a standard view.

The interesting detail about this exercise was the self-referenced view function used to create the drawing sheet. Instead of extracting 2-D information for each view, I attached a reference to the current file using predefined views. The effect: several rotated views of the model within the current drawing, all of which were automatically updated when the original was modified. I could then select a plane in which to work, draw all the dimensions in that plane, and reference them back to the attached files.

Like *AutoCAD*, *MicroStation PC* is a CADD engine. A multitude of third-party, highly sophisticated, application-specific software can turn *MicroStation PC* into the solution for many disciplines, including architecture, mechanical design, piping, plant design, mapping, and even geo-



MicroStation PC has an easy time with the test image. Hidden-line removal has been activated for these views, but reference files have yet to be attached.



A finished and fully dimensioned drawing of the 3-D part as produced by *MicroStation PC*. A hidden-line routine has been run on this file to make the drawing look better.

101 uses for your old dot matrix printer.

No. 24



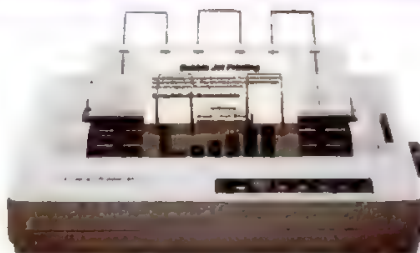
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With its reliable 48-nozzle print head, the BJ-130e provides resolution of 360 dpi in letter quality mode and speeds up to 240 cps in draft mode for crisp, clearly defined characters that won't smudge when handling documents.

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graphic information systems.

MicroStation PC could benefit from a good tutorial, associative dimensioning, and its upcoming graphical user interface. Even in its present state, it's easy to recommend this package—but for career CADD users only. It's as a workgroup CADD solution that *MicroStation PC* really shines. Its reference files make it the state-of-the-art package for networked CADD workgroups.

Personal Designer

by Jim Boyce

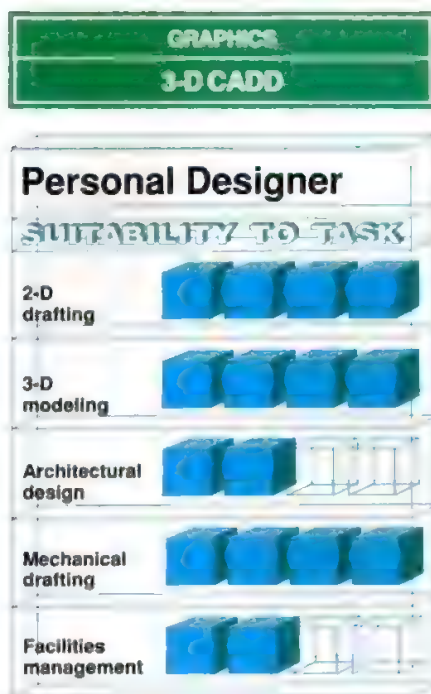
When it comes to 3-D modeling and engineering design in the workstation arena, Computervision has long been recognized as a major player. In the DOS market, the company takes a modular approach to the topic with its *Personal Designer* system. The \$3,900 *microCADDs GCD* module (*Personal Designer's* graphics editor) offers capabilities well above those found on comparable systems. Coupled with the \$1,900 *microCADDs Surfaces*, you have a system that comes close to bringing workstation CADD power to the PC.

The menu-driven installation process allows you to optimize your system and install optional packages such as *Surfaces*. Because the installation routine is well written, setup is painless.

Because of copy protection, however, installation gets a little tricky. Computervision uses a combination of a hardware lock and software code numbers to provide software security. To receive security codes the new user must call Computervision; the company calls back to assign a string of security code numbers for each software module. Codes are installed on the system via a security configuration program. While it doesn't make setting up the software more difficult, it certainly does make the process more involved.

Personal Designer supports both mice and digitizing tablets. The optional screen menus are a combination of icons and keywords, making the mouse a good alternative to higher-priced tablets. In every case the icons are a good representation of what the function hidden behind them will do, which makes learning the program a snap. An experienced CADD user can be up and running in 2-D on the system in a single day.

Direct command entry on the prompt line allows more flexibility with many of the commands than is available from the



menus. But like many workstation-based systems, command syntax and the sheer number of options available may make keyboard entry puzzling to the new user. Not to worry. The screen interface is so complete that even seasoned users won't

need to touch the keyboard very often on most projects. What makes learning the command syntax worthwhile is the ability to use other commands transparently within the current one by simply typing in its modifier. Display options, grid size, and the use of entity selection filters are good examples of the many commands that can act transparently.

PERFORMING UP TO PAR

Personal Designer performs a number of general geometry-manipulation actions very well. A host of construction line functions let you generate construction entities, and a wide range of functions help you easily copy, move, and edit existing data. You can use absolute or relative specification for both linear and polar location of points, and in many cases you need only enter the x or y coordinate.

Personal Designer's entity selection filters and techniques are probably some of the best and most versatile in the PC realm. You can select entities inside the selection window, outside the window, crossing, inside and crossing, outside and crossing—and many other combinations.



PERFORMANCE TESTS: HIGH-END CADD PROGRAMS

How We Tested High-End CADD Packages

The increasingly widespread use of fast 386-based PCs with speedy processing and addressable high memory has affected the CADD arena since our last review of high-end packages (*PC Magazine*, August 1988). Our testing platform was a Compaq Deskpro 386/25 with a 60MB hard disk, 4MB of 32-bit system memory, a built-in cache controller, and an 80387 math coprocessor; this is the kind of high-end platform one needs to run top-of-the-line CADD software optimally.

Our evaluations of CADD software emphasize their 3-D capabilities. We asked each reviewer to create a 3-D wireframe part model, a 2-D drawing of the model, and a shaded rendering depicting the final product. If possible, the 2-D drawings were to be instanced off the wireframes; that is, pulled directly off of the earlier images. Not surprisingly, some 3-D packages don't support instancing—or they claim to support it but don't do it very well.

The mechanical part we asked our reviewers to draw was designed to test a package's functionality as both a 2-D and a 3-D drafting tool. In 2-D, to test dimensioning, we included several dimensions (lines, diameters, and radii) in the drawing.

We included an inclined surface with an intersecting cylinder to test the package's ability to deal with the resulting elliptical curve at the point of intersection, and to see how well the curved shape could be shaded. We added holes in the part's base to test 3-D surfacing capabilities. Had the base been totally solid, any program that could surface would have had no trouble. But with the holes present, several programs required the shaded base to be built from smaller pieces and then stitched together.

Our reviewers also tested the ability of each package to import .DXF files (the neutral file format defined by Autodesk) by reading in a 2-D drawing created in *AutoCAD*, Release 10. As a further test, we asked each reviewer to hatch a complex bordered region with a circular island in the center (supplied as a .DXF file). Three years ago this test would have tripped up half the programs we reviewed. Today, most high-end packages pass without a hiccup.

We also submitted each package to a series of speed tests measuring the time it required to regenerate a screen with a complex 2-D drawing displayed and to delete every entity on the drawing.

CONTINUES

money back guarantee. **HYUNDAI** Warrants products free from defects and agrees to repair the broken ones up to 18 months from the date of purchase. **NEC** If warranty card is mailed within TEN (10) days of purchase, NEC agrees to repair or replace any part of the enclosed unit which proves defective for a period of ONE (1) year. Warranty void as a result of service by anyone other than NEC, authorized service center. **ZENITH** Effective for ONE (1) year, ZENITH will pay for service and labor by a ZENITH approved service center, when needed as a result of defective workmanship and materials. **ACER** TWELVE (12) month warranty. If sales receipt is returned within TEN (10) days, on-site service, limited to 50 States, will be provided for four months. **EPSON** Warrants product free from defects in workmanship and materials for ONE (1) year given only normal consumer use in the United States and service from none other than an authorized Epson Service Center. **AST** Warrants free from defects in materials workmanship for 12 months for systems sold by dealers and 14 months when purchased direct from AST. **IBM** During ONE (1) year warranty period, that begins with date of purchase, IBM or an IBM Authorized Dealer will provide warranty service. **COMPAQ** During the ONE (1) year warranty period, Compaq will repair with new or refurbished parts, at its own option, any defective product. Warranty void as a result of service by anyone other than Compaq or Compaq dealer. **ALR** Warrants products free from defects and agrees to repair the broken ones up to one year from the date of purchase. **WYSE** Warrants products free from defects for a period of ONE (1) year. At its option, WYSE will either replace or repair defective products. Warranty void as a result of service or modification by anyone other than a WYSE authorized service center. **Everex** Warrants product, excluding monitors, assemblies and components that may be replaced for a period of SIX (6) months but not less than 90 days from date of system manufacture. **Everex** Service Centers are free of charge. Defective products will be replaced unless damage resulted from misuse. During the ONE (1) year warranty period, Everex will properly repair or replace defective products. **HARD BELL ELECTRONICS** Warrants systems to be free of defects for ONE (1) year. If the product does not meet these standards, call Hard Bell for the local service center nearest you.

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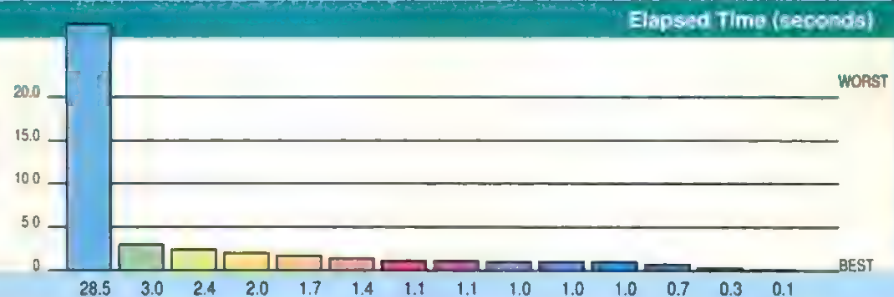


PERFORMANCE TESTS: HIGH-END CADD PROGRAMS

FastCAD lives up to its name, but all-time market leader **AutoCAD** also holds its own in our speed tests of high-end CADD packages.

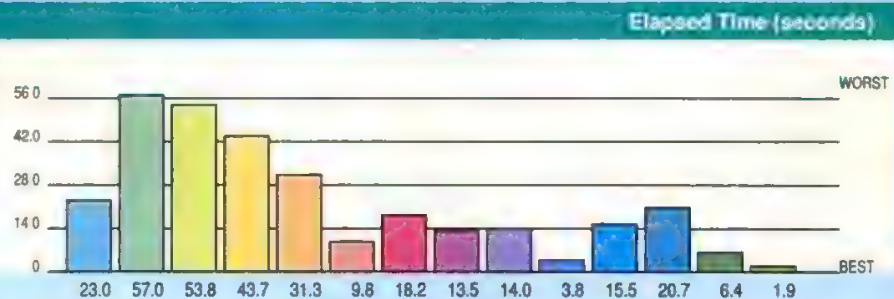
Mass Entity Deletion

The **Mass Entity Deletion** test measures the time it takes to delete the entire top and front views of a multiview .DXF file. Stopwatch timing begins when the delete or erase command is invoked and ends when the areas have vanished from the screen.



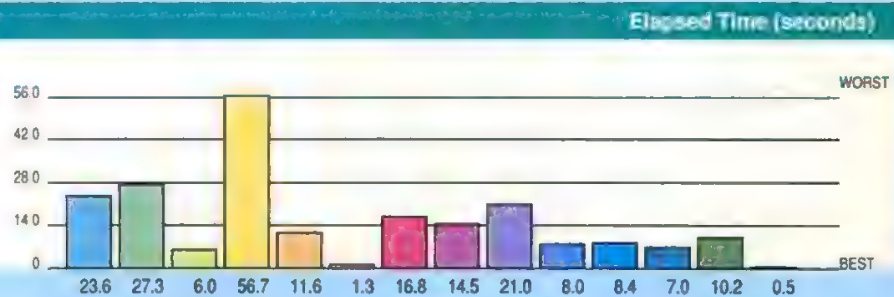
Entity Select

The **Entity Select** test measures the time it takes to erase selected entities in a .DXF file using the Group Select procedure for each CADD package. Timing begins when the delete command is executed and stops when the entities have been erased.



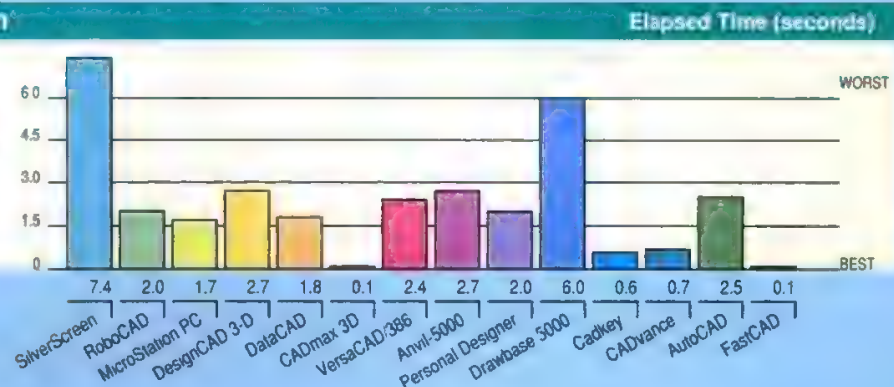
Full-Screen Generation

The **Full-Screen Generation** test measures the time it takes to redraw a two-dimensional .DXF file. For both screen generation tests, timing begins as soon as the first entity appears, and ceases when the last entity has been completely drawn.



Select Screen Generation

A second display test, the **Select Screen Generation** test, measures the time it takes to generate a .DXF file of a select group of entities. Since some packages store virtual screens in memory and do not fully redraw the entities, the equivalent of REGEN rather than REDRAW (in AutoCAD terminology) is used.



CONTINUES

An unexpected but very welcome feature comes in single-entity selection. If you mistakenly choose an entity you don't want in the group, simply pressing a mouse button rejects it and takes it out of the set, allowing you to continue uninterrupted selection. If there are multiple entities that fall under your pick box, *Personal Designer* has the intelligence to step through the possible entities as you reject them, rarely picking up the same one twice. This feature takes all the aggravation out of selecting entities that are either coincidental or very close together in the view.

Everything that *Personal Designer* does in 2-D it does well. Dimensioning and text entry are everything you would expect from a system of this caliber and its icon-driven dimension setup screen gives you quick and easy control of tolerance styles and values, dimension styles, and physical dimension features. It also provides built-in geometric tolerancing groups that can be selected and inserted via icons. But for all its power and ease-of-use in 2-D, what really sets *Personal Designer*

Personal Designer, Version 4.0
Computervision, Prime Computer Co., 100 Crosby Dr., Bedford, MA 01730; (800) 248-7728, (617) 275-1800.

List Price: Standard edition (*microCADD* S GCD), \$3,900; DOS-Extended Edition, \$5,800; surfaces and shading module (*microCADD* S Surfaces), \$1,900.

Requires: 2MB RAM, Intel 80387 math coprocessor, DOS 3.1 or later. Mouse or digitizing tablet recommended

In Short: With *Personal Designer*, Computervision has successfully bridged the gap between workstations and PCs for complex surface modeling, albeit at a rather high price. Its 3-D facilities are a cut above those of many other CADD programs. Copy protected.

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POWERFUL SURFACE AND SHADING FEATURES

The optional *Surfaces* module provides functions for creating tabulated, ruled, swept, extruded, and Coons-patch surfaces using lines, arcs, curves, and special curve-definition entities called cpoles. The sheer number of functions for creating and modifying surfaces is impressive, but the fact that they are so simple to use is even more so. (*Personal Designer*'s emphasis on surface modeling—it offers some of the most sophisticated tools in this area available for a DOS machine—results in the absence of solid modeling functions.)

Functions to create planes and use them to find their intersections with a surface, automatically generating a string at the intersection, exist; surface-to-surface intersection can also be defined by invoking the function and simply identifying the surfaces involved. Also included are functions to fillet, join, and smooth surfaces.

Shading is handled externally by a program supplied with the surfaces option. To generate a shaded image, you select the view of the object as a wireframe in the

apart from other CADD packages is the surfacing and shading capability you will find in its *microCADD* S Surfaces module.

PERFORMANCE TESTS: COMPOSITE VIEW

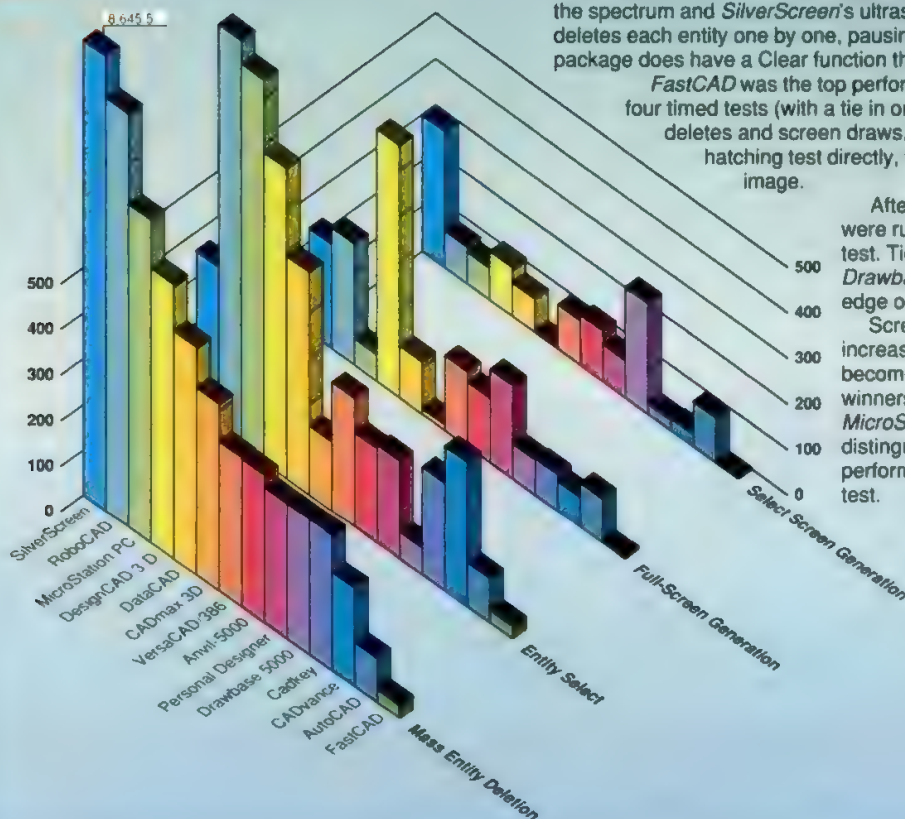
The greatest differences among packages showed up in the Mass Entity Deletion test, with *FastCAD*'s nearly instantaneous performance on one end of the spectrum and *SilverScreen*'s ultraslow timing on the other. *SilverScreen* deletes each entity one by one, pausing to refresh the screen every time. (The package does have a Clear function that erases the screen in one step.)

FastCAD was the top performer across the board, handily winning all four timed tests (with a tie in one instance). This 2-D package excels at deletes and screen draws, but it was unable to perform our cross-hatching test directly, tripping on the "island" effect in the image.

After *FastCAD*, *AutoCAD* and *CADvance* were runners-up on the Mass Entity Deletion test. Tight Group Select algorithms in *FastCAD*, *Drawbase 5000*, and *AutoCAD* gave them the edge on the Entity Select test.

Screen generation of images becomes increasingly important as your image files become larger. The Full-Screen Generation test winners were *FastCAD*, *CADmax 3D*, and *MicroStation PC*. *CADmax 3D* again distinguished itself by matching *FastCAD*'s performance on the Select Screen Generation test.

Relative Times
(AutoCAD = 100)



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editor and then invoke the Shade command. This allows you to set reflectivity, opacity, and other characteristics for individual surfaces. A single command then sends the necessary data to a separate file that the shading program uses.

microCADDs Surfaces uses gray-scale shading on VGA rather than color. Since gray scaling trades color for higher resolution and smoother imaging, the resolution and appearance of the image is extremely good. This setup works extremely well for design visualization.

The shading program also offers two modes for shading—faceted and smooth. Faceted shading is quicker than smooth shading because the smooth option generates a finer resolution. The only desired improvement here is to integrate shading within the graphics editor.

Computervision offers other optional modules for *Personal Designer*, including a *Finite Element Analysis* package and an extensive user program language called

UPL. *UPL* offers a sizable toolkit of functions and programming facilities to manipulate graphic data, perform calculations, access disk files, and more. With an extensive user-group network, finding *UPL* programs already written to fit your special needs is easy.

Incorporated in the *microCADDs GCD* module of *Personal Designer* are .DXF and IGES translators. A DOS-extended version of *microCADDs GCD* for 386-based machines is available for \$5,800; you can also purchase versions designed for the Sun SPARCstation and 386i.

With *Personal Designer*, Computervision has combined ease-of-use and powerful surfacing to successfully bridge the ever-narrowing gap between PCs and workstations. If you need serious surface-modeling capability that's backed by one of the major players in the CADD game, this is the system for you.

RoboCAD

by Jim Boyce

After trudging through command- and menu-driven CADD software, it's a real treat to work with *RoboCAD* (\$2,000) and *RoboSolid* (\$2,000), two easy-to-use, icon-driven programs. As parts of Robo Systems International's modular package for design and analysis called *RoboDesign*, these products pack a lot of power for the engineer and drafter alike.

Both of the modules that are reviewed here include installation programs that make setting up directories, choosing devices, and configuring the system a simple 10-minute job. Happily, this simplicity

While *RoboCAD* doesn't have a few of the features found in other CADD programs, all of the essentials are covered, and in some areas it really performs.

carries over into system operation as well, thanks mainly to the excellent design of the user interface.

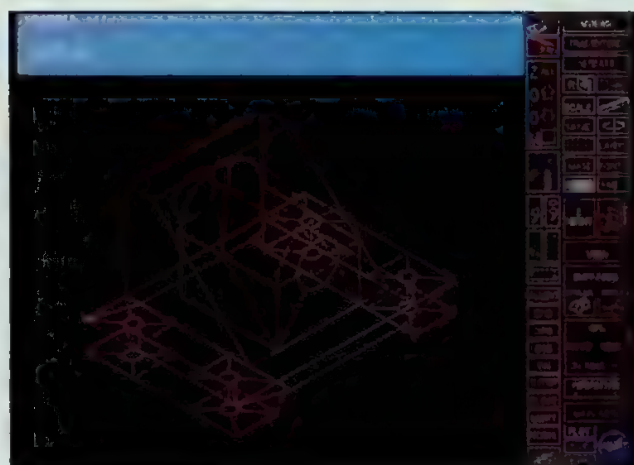
RoboCAD and *RoboSolid* both offer pop-down menus and dialog-box status lines, but the real spark comes from their icon menus. Nearly every command selected from the pop-down menu generates a combination of icons and dialog boxes that can be moved to any point on the screen. A click of a mouse button sends them back into limbo again when they are no longer needed. The icons help a novice to become proficient in a short time without relying heavily on the tutorial or manuals. And an experienced CADD user could easily become productive in both 3-D and 2-D in a single day.

A WINNER IN MANY RESPECTS

While *RoboCAD* doesn't have a few of the bells and whistles found in other CADD programs, all of the essentials are covered, and in some areas it really performs. The



Personal Designer's dimensioning setup screen gives you a good idea of how complete its set of drawing tools is. Virtually every kind of dimensioning is available here.



Creating a complete 3-D wireframe image isn't too much of a challenge for a program as powerful as *Personal Designer*. All the tools you need are always close at hand.

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- ☐ **INDIVIDUAL CREDIT**. Complete sections "a" and "b" only

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Applicants must be 18 years of age or older.

a. Your Personal Information

Your Name						First		Initial		Last		Date of Birth:		Mo		Day		Yr		Social Security Number	
Present Address		Street		Apt. #		City		State		Zip		Home Phone		()							
Date of Residence:		Month		Year																	
Previous Address:																					
Your Employer: (If self-employed, see rear panel)																					
Employer's Address:		Street				City		State				Business Phone		()							
Previous Employer:																					
Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation																					
Other Income																					
I have received since (Date)																					
Monthly Income Gross \$																					
Net \$																					
Name and Address of Nearest Relative Not Living With You																					
Relationship																					

b. Credit Information

Bank Account		Bank Name		Address		L. Checking		Savings	
Bank Account						Checking		Savings	
Bank Loan Reference						Payment		Balance	
Bank Card Reference		VISA							
Bank Card Reference		MasterCard							
Other Credit Card Reference									
Other Credit References		Account No.		Expires					
Driver's License No.		State		Expires					

c. Joint Applicant's Personal Information

Joint Applicant's Name						First		Initial		Last		Date of Birth:		Mo		Day		Yr		Social Security Number	
Address		Street		Apt. #		City		State		Zip		Date of Residence		Mo		Yr		Home Phone		()	
Employer																					
Date of Employment		Mo		Yr																	
Position																					
Monthly Income		Gross \$																			
Net \$																					
Employer's Address		Street				City		State				Business Phone		()							

d. Self-Employed Information

Business Name						Proprietorship		Corporation		Partnership	
Business Address								Business Telephone		()	
Description of Business								Your Position		in Business Since	
Your annual income from business								Business annual income		gross	
										net	
You must provide at least one of the following											
1. Business Bank		Name				Telephone		()		Personal Banker's Name	
2. Accountant's Name										Telephone	
										()	
3. Financial statement on business attached											

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Text is an area where other packages could take a few pointers from *RoboCAD*. As with dimensioning, all variables are controlled by icons and dialog boxes. Text is entered via a full-screen editor that offers complete cursor control and the ability to edit single or multiple lines of text. When you are finished entering your text it's attached to the cursor for dragging into posi-

SUITABILITY TO TASK

2-D drafting	
3-D modeling	
Architectural design	
Mechanical drafting	
Facilities management	

Of course no program is perfect, and *RoboCAD* is not an exception. Without

enough extra memory to contain the entire program, the system can be slow because it becomes heavily disk-intensive. Also, basic features, such as associative dimensions, creation of polygons, and automatic trimming of lines after fillet and chamfer, are missing. The package also lacks some of the instant point snaps, like midpoint and quadrant, that make drawing construction a much simpler task. The next release—*RoboCAD 20*, due out by the end of the first quarter in 1990—will not only address those areas but will go well beyond, offering multiple DOS windows, keyboard commands, timed auto-save, networking support, an integrated drawing control system, and an integrated, full-featured word processor.

For creating solid models, *RoboSolid* offers the same ease-of-use as *RoboCAD*.

RoboSolid provides four viewing styles: wireframe, hidden lines removed, hidden lines shown dashed, or shaded.

SET UP DRAW EDIT VIEW LIBRARY TOOLKIT SOLID ANALYSE

ROBOSOL 1102

Make selection X = 4.46 Y = 0.331 Z = 2.643 bearing

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PROXIMA
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The image can be changed from perspective to isometric projection at any viewing angle in any of those modes. Light-source location, intensity, and depth-cuing are controlled by sliding bars. Solids can be mirrored or sectioned, with sections exportable to *RoboCAD* in 2-D. And when mass properties are needed, weight, volume, surface area, CG, moments of inertia, and products of inertia take only seconds to calculate.

With additional memory or a virtual disk to cut down on disk access, the program models and repaints very quickly—you won't have time to make a trip to the water cooler or call a friend while waiting for it to finish an operation. All of *RoboSolid's* features and ease-of-use combined to make creating the test model and exporting it to 2-D a painless 15-minute process.

If you're looking for a modeler to paint beautiful, photo-realistic images on your screen, look elsewhere. That's not what



FACT FILE

RoboCAD, Version 4.2
 Robo Systems International Inc., 105 Terry Dr., Newtown, PA 18940; (800) 221-7626, (215) 579-1344.
List Price: *RoboCAD*, \$2,000; with solid modeling module (*RoboSolid*), \$2,000; both programs, \$3,000.
Requires: 640K RAM, DOS 3.0 or later; mouse or digitizing tablet and Intel 80x87 math coprocessor recommended.
In Short: *RoboCAD's* excellent interface and ease-of-use make modeling and drafting a simple pleasure. It offers a number of advanced utilities that *AutoCAD* has yet to even consider.

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RoboSolid is all about. After all, the result you're after and the one *RoboSolid* provides is usually an accurate 3-D representation—not gratuitously impressive-looking images that take hours to produce and have absolutely no impact on your profit margin.

What else does the *RoboDesign* system offer? Availability in 20 languages, bills of material, time management and reporting, and wonderfully simple font customization—it's all in the package. With integrated surface modeling and finite-element analysis on the way, *RoboDesign* could even make a dyed-in-the-wool *AutoCAD* fanatic sit up and take notice.

SilverScreen

by Bruce Haase

SilverScreen by Schroff Development is the new kid on the block when it comes to CADD. Released just last summer, it was built from the ground up as a 3-D design and modeling package for the PC, but it's far more than that.

SilverScreen also gives you 2-D drafting, design, detailing, hidden-line removal, surface shading, mass properties, a built-in text editor, a built-in programming language, a BASIC and a C language compiler, and a seamlessly integrated walking camera that presents views of a part or plan as you move through or around it. Many CADD packages lack several of these features or offer them only as options, but *SilverScreen* includes them at no additional cost. Unbelievably, *SilverScreen's* price is one of the lowest in this category: \$995.

Installation is simple and straightforward, taking less than 5 minutes. All the software is copy protected, but no hardware key is required to operate the program. Once installed, you can fine-tune or modify *SilverScreen's* start-up defaults to suit your own preferences: screen and menu options, line styles and colors, data file directories, and input and output devices can all be altered from within the program.

The software will run on an 80286, but Schroff strongly recommends an 80386. A mouse or digitizing tablet is listed as an option, but you'll find one of them almost mandatory.

ON THE SILVER SCREEN

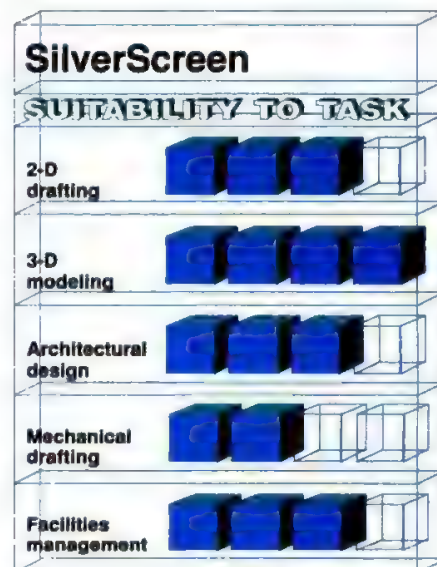
SilverScreen divides the display into four parts: the menu, a status and message box, the cursor coordinates, position box, and a drawing area. The menu structure, with icons and functions arrayed around the edges of the screen, is similar to that of *AutoCAD*, *Cadkey*, or *DesignCAD 3-D*. If you use a tablet, you'll find that *SilverScreen's* prebuilt template file is a handy item.

The program smoothly polished off the 3-D test drawing. Starting with the base, I drew a rectangle representing the front side. Next, I positioned a smaller rectangle over the existing one and filleted its corners with a .5-inch radius. To complete the front view of the base, I used a 2-D Boolean operation on the rectangles; 2-D Boolean operations should be mandatory

on all CADD packages, but *SilverScreen* is one of the few to actually provide this feature. This one, easy-to-use, single-step command replaces the several trim, break, and join operations that most CADD packages put you through.

The last step was extruding the front of the base to create a solid object. *SilverScreen* calls extrusions sweeps, and it offers several of them: Linear, Surface of Revolution, Radial, Spiral, and Join. You can sweep not only lines, primitives, and points, but solid objects as well.

Once the base was complete, I placed a block on top of it and sliced it on a diagonal to create a slanted surface. With the block



complete, an arc and rectangle were 2-D Booleaned on the rear surface of the block. This new object was extruded forward, and a hole was inserted at the proper location and extruded through the slanted block. Another Boolean operation joined the block and the newly created objects, the holes in the base were Booleaned, and the part was finished.

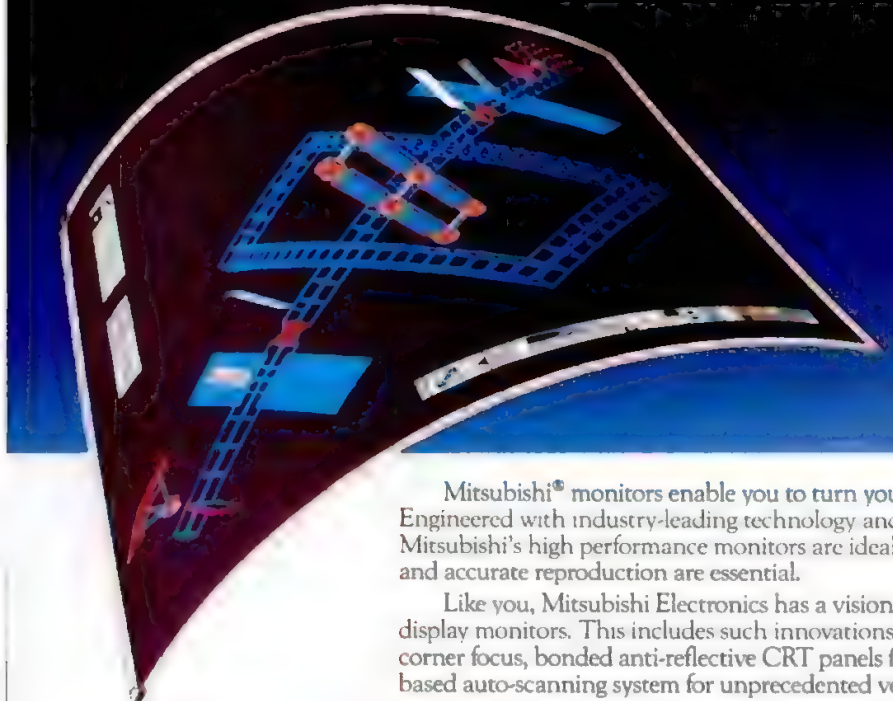
SilverScreen's cursor has dynamic highlighting to help in editing or object placement. Once the correct object is highlighted, pressing the Return key or clicking the mouse selects it. When you're working in tight places with several lines and objects crossing each other, the dynamic cursor almost totally eliminates grabbing the wrong object or entity.

A VARIETY OF VIEWS

In 3-D, it's nice to work with four views showing: front, top, side, and isometric. In fact, *SilverScreen* gives you as many as nine views on the screen at once. Each



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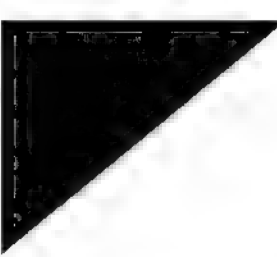
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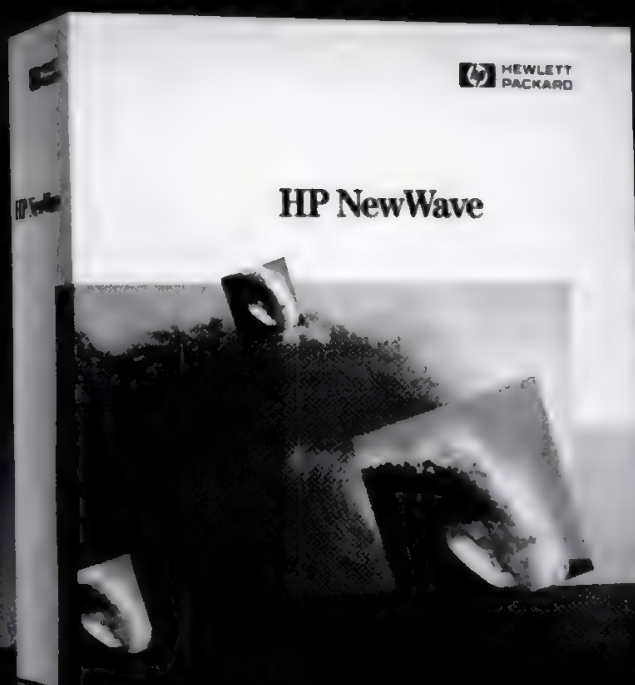
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view window defaults to a different preset view but is also user-definable.

SilverScreen brings a unique feature to the window option by allowing a completely separate drawing to be loaded into one or more of the windows; this lets you work on the new drawing as well as your current drawing. The different data files in each window are open, active, and modifiable. You can also copy objects or entire windows to another window or data file.

It's also possible to split the screen into several windows and have the same view in each window. You can show the part from start to finish: wireframe, hidden line, shaded, shaded with background and different colors, and lighting. Because *SilverScreen* is a surface-modeling package and the drawing was constructed as a solid, you don't have to jump through hoops to accomplish this. It's all done from simple menu-command choices.

The shading routine is fast (9.5 seconds for the 3-D test part) and excellent in its

GRAPHICS 3-D CADD

PC FACT FILE

SilverScreen, Version 1.10X
Schroff Development Corp., P.O. Box 1334, Shawnee-Mission, KS 66222; (913) 262-2664.
List Price: \$995.
Requires: 640K RAM, math coprocessor, DOS 3.0 or later. Mouse or digitizing tablet and 80386 processor strongly recommended.

In Short: *SilverScreen* delivers more features and better performance than most 3-D CADD packages regardless of their prices. Its shading and solids capabilities are remarkable. Copy protected.

CIRCLE 548 ON READER SERVICE CARD



rendering. You can shade the background, assign up to 15 different colors to surfaces, and put 38 predefined patterns on top of any surface. You can also create new pat-

terns, shade or color the patterns differently from the surface color, and alter the lighting source and the camera perspective.

SilverScreen's 2-D drawing capabilities are comparable to any package I have used. Standard drawing, editing, and snap features are available. The dimensioning is fully associative. Any dimension attached to an entity that is resized or modified will automatically be redimensioned. *SilverScreen* also provides an undo command in either 2-D or 3-D. It's unbelievable that some CADD packages still fail to offer this feature.

The program's text editor gives you full control when entering annotations writing memos and notes into drawings. *SilverScreen* also accepts ASCII output from any word processor.

If *SilverScreen* has forgotten your favorite feature or menu command, you can make it yourself. *SilverScreen* has a built-in programming language (*SilverSmith*) and includes macro routines and a remember-key function. More-ambitious programmers will want to delve into the built-in BASIC and C compiler.

LITTLE TROUBLES

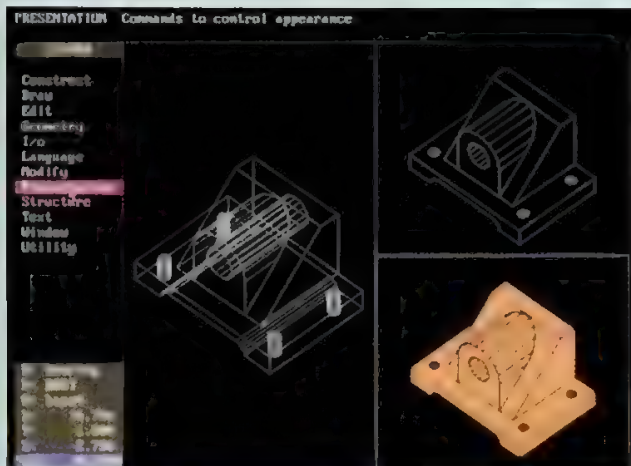
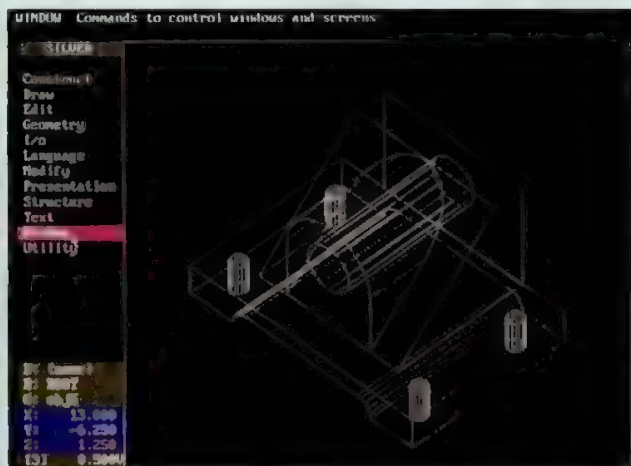
SilverScreen did have some trouble passing the .DXF import test. Although the drawing translated well, the dimensioning details did not. *SilverScreen* stores .DXF dimensioning data as an internal model; it's not modifiable or accessible. Several extraneous lines, connecting one view to another, were also added. The same results occurred on an IGES transfer.

I was also unable to change the number of decimals used in the dimensioning notations. In spite of my setting it to two places several times, *SilverScreen* insisted on accuracy to four places.

The F1 key or a menu selection brings up an extensive on-line help system, but once in the middle of a command or an editing or drawing sequence, you cannot access help—you have to escape out first. This lack of transparency also crops up in editing and drawing situations where you cannot zoom or pan in the middle of a command.

SilverScreen is a sloth when it comes to mass deletions and erasures. Ironically, the time for the mass entity deletion test was actually longer than for the clutter deletion test. One of the reasons for *SilverScreen*'s turtle-like behavior in this area is that the screen regenerates itself after each entity is erased.

Priced at \$995, *SilverScreen* is the second-least expensive of the packages in this evaluation. This screen shows a completed wireframe drawing in isometric view.



An unusual feature of *SilverScreen* is its ability to show you a wireframe part, a hidden-line part, and a shaded part all on the same screen at the same time.

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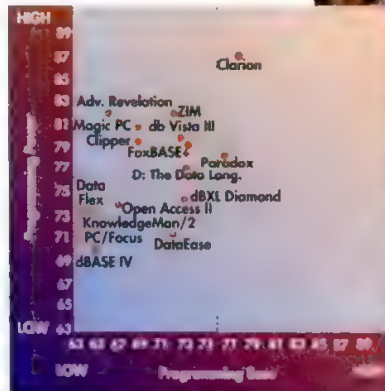
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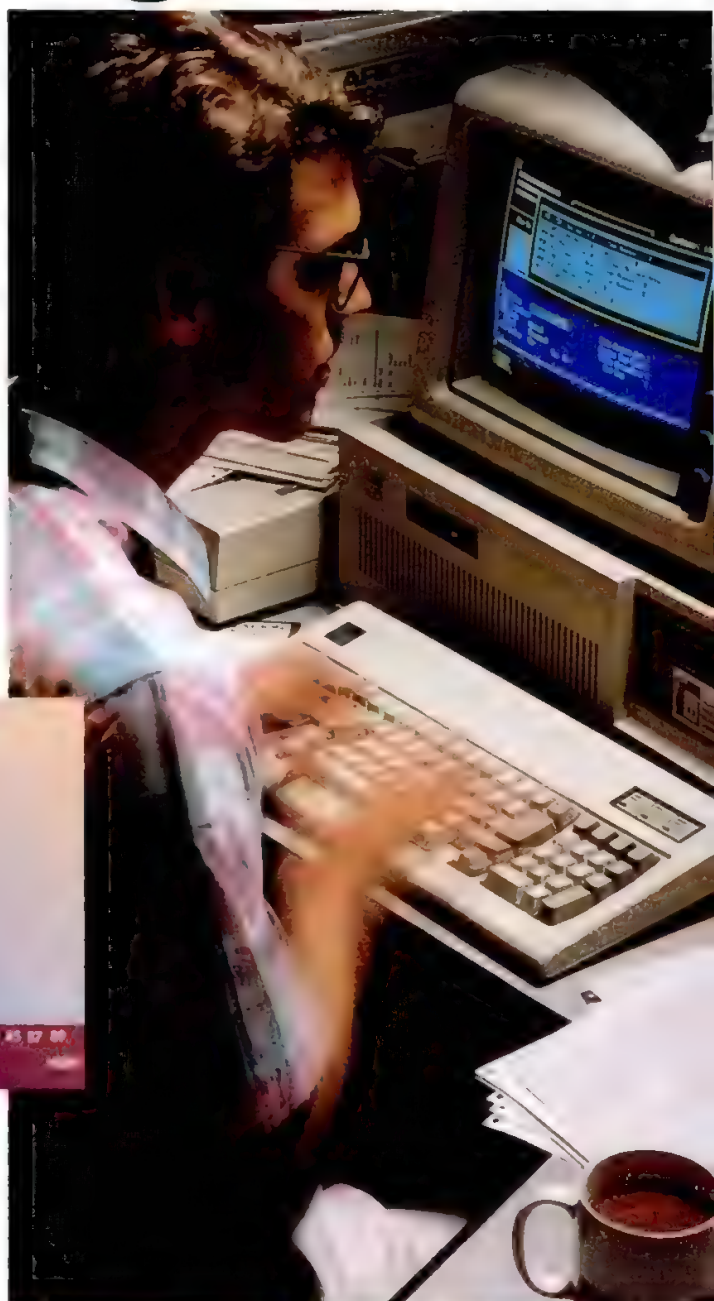
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GRAPHICS 3-D CADD

However, these few problems cannot dull the luster of *SilverScreen*. If you're looking for a solid 3-D package under \$1,000—and you like the idea of getting more features than many market leaders offer—look no further.

VersaCAD/386

by Will Schleter

VersaCAD/386 is the newest member of VersaCAD Corp.'s family of computer-aided drafting and design products. Designed to take full advantage of the 80386 processor, the \$3,495 program remains fully compatible with its predecessors

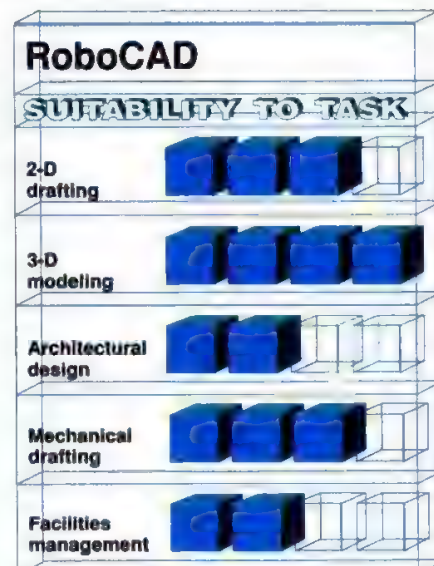
while providing increased performance. As a 2-D drafting system, *VersaCAD/386* has a full array of features that are comparable to those of any PC-based CADD package. As a 3-D modeler it is a workable system but with some limitations.

The system is modular in design; a shell program controls access to the Drafting (2-D), Modeling (3-D), Bill of Materials, QuickRender, Output Utilities, Translators, Customization, and Environment modules. Files can be transferred between the different modules. A CADD programming language (CPL) is available for customizing the system, as are fully configur-

able menus and a learn mode for creating tablet and function-key macros.

UP AND RUNNING

A QuickStart pamphlet provides all the information required to perform the installation. If you load all modules, be prepared to give up about 8MB on your hard disk. Once installed, the configuration may be reviewed and modified at any time.

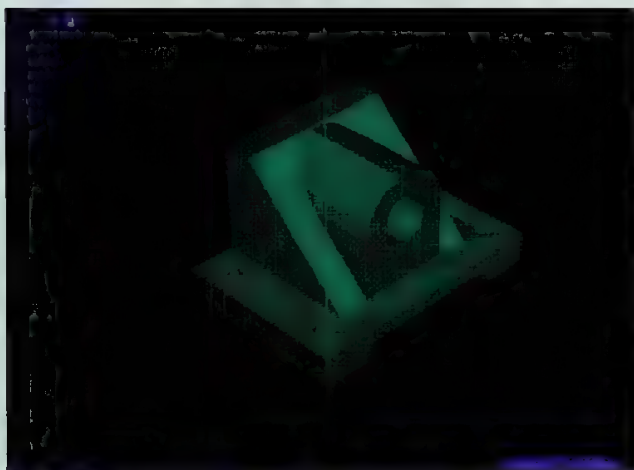


The only disconcerting part about the installation is that it requires you to enter a workfile size, which determines the maximum number of objects in any one drawing. Too low a value and you are limited to small drawings. Too high a value introduces unnecessary overhead.

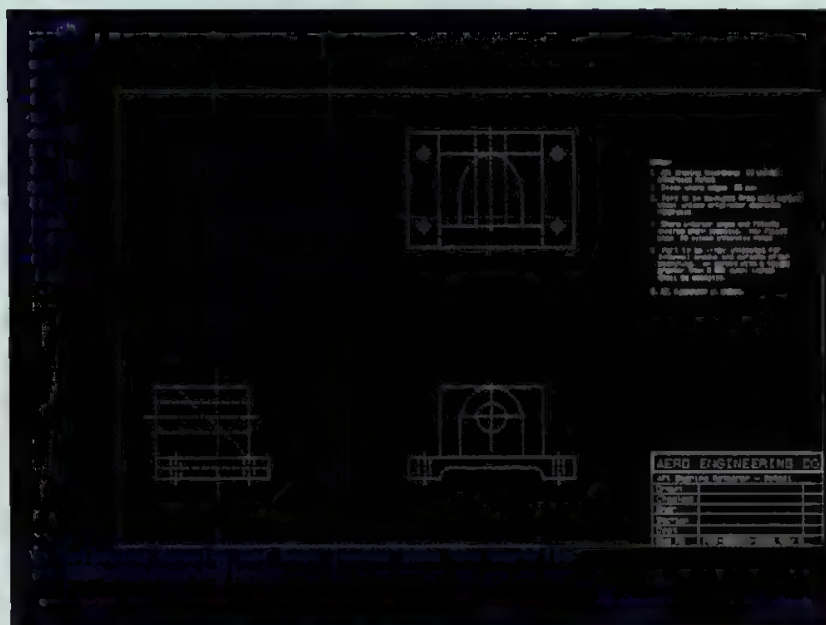
The QuickStart pamphlet's tutorial, intended to get a novice started, proved to be frustrating because it provided several faulty descriptions. The most notable was when I attempted to load a symbol for a door and a toilet appeared on the screen!

Communicating with *VersaCAD* is not easy, especially for a new user. Most functions are available from the on-screen menus, but some are available only from the function keys or numeric keypad. The use of a digitizing tablet makes most of these problems disappear, but with a mouse, moving among menus can be frustrating. The highlight bar stays at the same screen position from one menu to another. If the new menu contains fewer items than the previous one, the highlight bar disappears completely. If the cursor is moved out of the graphics area during object modification or group selection, there is no way of determining which object is the currently selected one.

But perhaps the most frustrating char-



Generating this shaded view with *VersaCAD/386* is relatively easy, but getting the necessary information from 2-D to 3-D format is a bit of a chore; it required some manual patching in this case.



This screen shows the results of importing a supplied .DXF file into *VersaCAD/386*. Like many other programs, *VersaCAD* lost the dimensioning details during the process.

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acteristic of the user interface is that it gives you two ways of exiting a menu: Quit and Esc. These options are next to each other in the menu, and it is very easy to inadvertently choose Esc instead of Quit—with the result being that all objects created with that menu disappear forever.

On the plus side, *VersaCAD* has probably the most complete set of options for selecting a group of objects of any CADD system.

VERSACAD IN ACTION

The 2-D drawing of the test part was created without difficulty.

The 2-D drawing could also have been created by building the 3-D model first and then transferring the orthographic views from the Modeling module back to the Drafting module. However, this approach has a distinct disadvantage. Everything from the 3-D modeler transfers back as facet edges (lines); thus, dimensioning is complicated and the design intent is lost. It

takes additional time to remove the undesired lines. In some cases, a combination of creating 2-D geometry and extracting views from the 3-D model will prove to be the best solution.

Creating the 3-D model of the test part was a chore. The approach taken was to assign thicknesses to various portions of the 2-D drawing and then transfer this data to the Modeling module. However, if the cross section being extruded contained holes, the top and bottom surfaces weren't trimmed accordingly. To get the correct representation, I had to create a patchwork of surfaces by hand, using the edge points of the extruded surfaces. This was a tedious and error-prone task. Once it was finished, though, a shaded display and hidden-line-removal display were created with ease.

One of *VersaCAD*'s strengths is its ability to display up to 16 viewports with any

find many ways to perform every function the package offers.

DesignCAD 3-D offers many complex 3-D modeling functions at a much lower price than its competitors (\$399), but inflexibility and lack of necessary features in its 2-D editor are drawbacks.

At \$995, *SilverScreen* has a powerful price and features ratio. Its 3-D tools are fully implemented and include shading capabilities and a surface modeler. The program will show nine different views on the screen, and you can display two completely different drawings and work on both of them simultaneously.

Drawbase 5000's ease-of-use, excellent drawing aids, and unmatched database facilities make it the state-of-the-art CADD system in the PC realm for architects and facilities managers alike. If its \$4,995 price is too high for you, *CADworks* has a number of stripped-down, less-expensive versions worth investigating, and *ISICAD's CADvance* (\$2,995) also remains a viable alternative for facilities managers.



EDITOR'S CHOICE

- Cadkey
- MicroStation PC

In our last high-end CADD roundup ("High-End CADD: Expanding to New Dimensions," August 1988), *Cadkey* and *AutoCAD* earned Editor's Choices. This year, *Cadkey* is even better. This package is a full-featured winner no matter how you look at it, and *Cadkey* is committed to keeping it that way. No other package offers the blend of 2-D functionality, 3-D versatility, and ease-of-use that *Cadkey* does.

AutoCAD remains the single best package you can get for 2-D mechanical drafting. But while its features in that realm are unsurpassed, it still has a few things to fix before it can be called the best 3-D package.

Our other choice is *MicroStation PC*, a powerful package that is pointing the way to the future of multiuser CADD. This is an extremely grown-up product, designed for use with multiple simultaneous access to files and data. There isn't anything you can't do with the program, except for 3-D Boolean solid operations. The extent of customization available in *MicroStation PC* is unlimited. You'll

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PC EDITOR'S CHOICE

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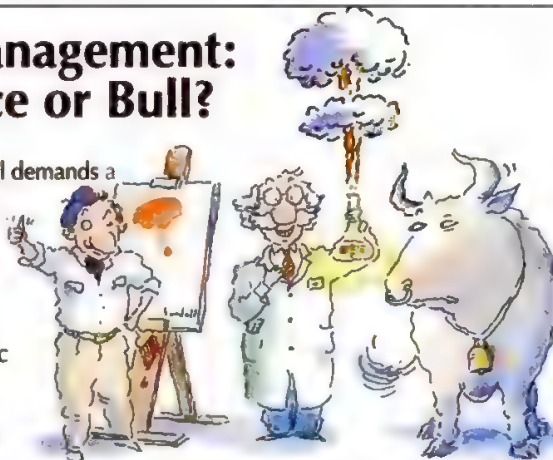
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GRAPHICS

3-D CADD



FACT FILE

VersaCAD/386,
Version 5.4
VersaCAD Corp., 2124
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Beach, CA 92648; (714)
960-7720.

List Price: \$3,495.

Requires: 3MB RAM
(1MB conventional and
2MB extended memory), 80386 processor, math
coprocessor, DOS 3.0 or later. Mouse or digitizing
tablet recommended.

In Short: VersaCAD's somewhat clumsy user
interface, the separation of its 2-D and 3-D
modules, and its limited surfacing capabilities
detract from an otherwise sound system. The
drafting module offers a wide range of
dimensioning capabilities, while the modeling
module is capable of producing impressive
displays—if you put in the work.

CIRCLE 149 ON READER SERVICE CARD



combination of wireframe, hidden-line, shaded, orthographic, and perspective views. However, it can be difficult to get the desired orientation of a view without calculating a position for the eyepoint. To avoid this problem you can load the file into QuickRender. Strictly a viewing utility, QuickRender allows up to four light sources and up to four simultaneous views to be positioned, manipulated, and rendered with a myriad of options.

The testing of the .DXF translator produced mixed results. Reading in the .DXF file produced a drawing without a single dimension. However, in a loop test of the same drawing created with VersaCAD, the drawing was successfully written to and read from the .DXF format without any loss of data.

The system also has an IGES translator and a VLINK utility for moving files between the different hardware platforms VersaCAD supports. VersaCAD was able to easily crosshatch the test file by simply selecting all of the geometry and executing the hatch command.

With more than 80,000 users, VersaCAD is an established player in the PC marketplace. However, its performance, though solid in 2-D drafting, could use some improvement in the area of 3-D modeling. Like any high-end CADD package, the product demands a substantial investment in hardware and software, and that investment may be practical only for larger organizations with a vested interest in using the same system across a wide range of platforms and applications.

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LAN MEMORY REQUIREMENTS		FILE TRANSFER	CONNECTIONS
Without EMS	77K*	Background: IND\$FILE	Gateway IBM TIC Coax SDLC
With EMS	62K*	Concurrent Send & Receive	

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PC WEEK V.32 REPORT CARD

UDS

Reliability

8

Hayes AT
Command Set

8

Interoperability

9

Performance/
Data Compression

9

Quality of
Documentation

7

AVERAGE SCORE

8.2

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In earlier evaluations, *PC Magazine* honored the original UDS V.32 with an Editors' Choice Award and referred to V.3225s as, "the last modems you'll ever buy because they make optimum use of both voice phone lines and the PC's serial port."

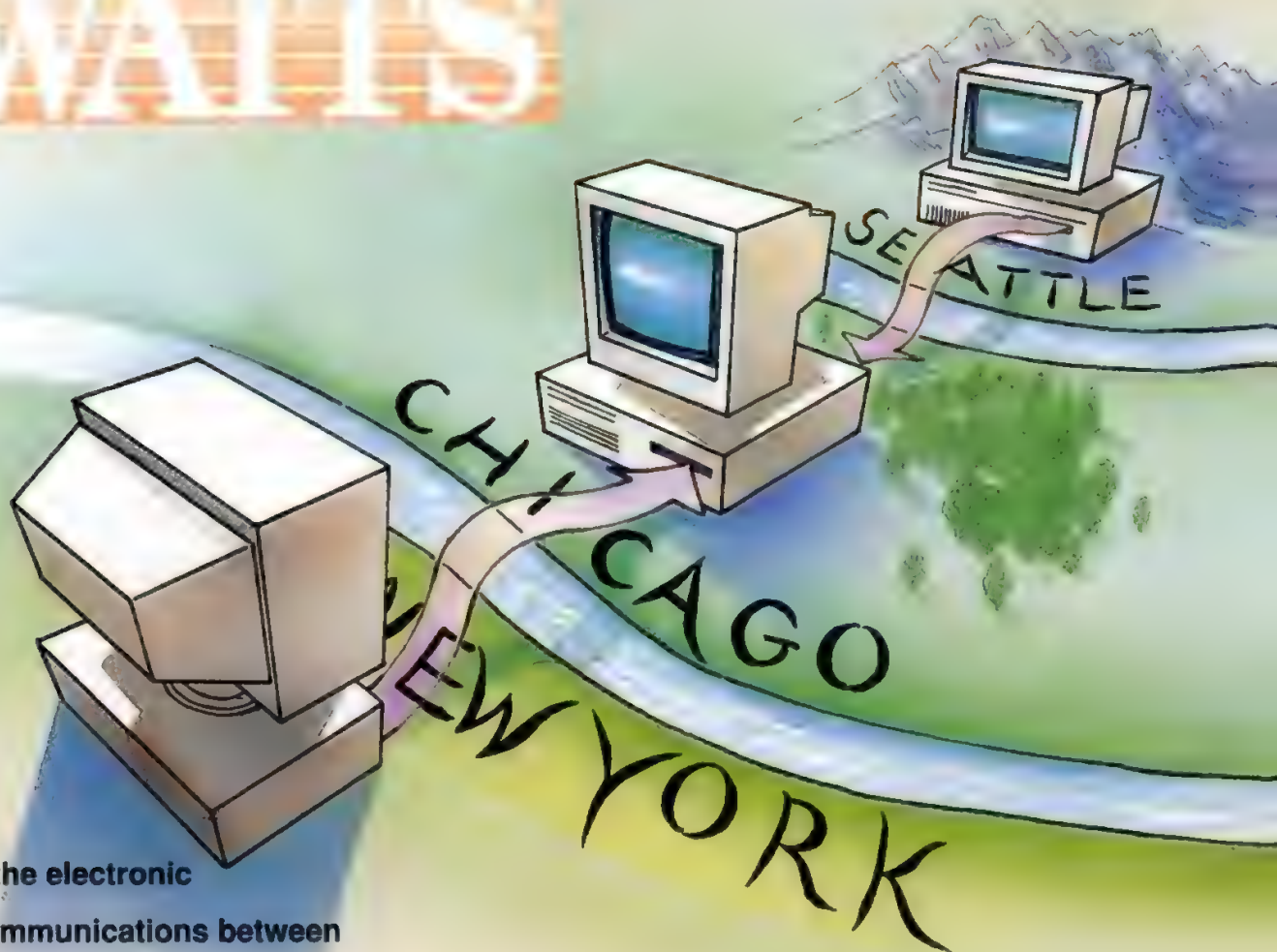
Besides technical leadership and outstanding performance, every modem in the UDS V.32 family offers **unconditional** compliance with the full V.32 standard. Learn how the UDS commitment to V.32 can increase your datacomm throughput over dial-up lines: contact Universal Data Systems, 5000 Bradford Drive, Huntsville, AL 35807-7002. Telephone 205/721-8000; FAX 205/721-8926.



CIRCLE 367 ON READER SERVICE CARD

BUILDING WORKGROUP SOLUTIONS
WIDE AREA INFORMATION TRANSFER SYSTEMS

WAITS



If the electronic communications between your headquarters and your remote locations aren't quite what they should be, a WAITS may be the perfect solution for keeping in touch. PC LAN Labs tests four leading contenders.

by Mike Byrd and Frank J. Derfler, Jr.

So much data, so little time! If you have information—files, reports, documents, databases, or messages—waiting for you around town or across the country, you should think about reeling it in with products we have christened Wide Area Information Transfer Systems—WAITS. WAITS products use PCs to move files economically and efficiently between locations that might be across the street from one another or thousands of miles apart.

Retail operations best exemplify how valuable a WAITS product can be. Take, for instance, a company with a retail chain of clothing stores spread throughout a large metropoli-

tan area or across the nation. The managers in each one of the chain's locations typically spend several hours a day—during and after business hours—compiling sales, inventory, and payroll reports. Instead of managing by walking around and ensuring good service for their customers, they're spending a lot of time acting as desk clerks!

Organizations equipped with WAITS give managers more time to manage by using a central clerical staff—the centralized software—to compile raw data and message it into the next day's balance sheets, inventory orders, and withholding tax deposits. WAITS products contact automated point-of-sale terminals in each retail operation by telephone or by some other electronic means; they withdraw the appropriate information, compile it, and then in turn provide the store manager and central operations staff with finished reports.

You can also use WAITS to link electronic mail systems on LANs, to update databases for businesses and organizations, and to print out messages in distant locations. Any organization with operations in more than one location can probably find a practical and profitable use for a WAITS.

A GROWING MARKET

The WAITS concept predates personal computers. In the 1960s, IBM marketed a point-of-sale and inventory system that could exchange information through modems. Crosstalk's *Transporter* program was an early MS-DOS application (we review the most recent version here), but the idea grew slowly. Now, developments like lower-priced long-distance telephone calls and private satellite networks, as well as the promise of the Integrated Services Digital Network (ISDN), have laid a firmer foundation upon which WAITS installations can rest.

Just-in-time delivery of inventory and increased accounting controls drive the need for the fast reports WAITS provides. OS/2 provides the multitasking capabilities that the most powerful WAITS products will need.

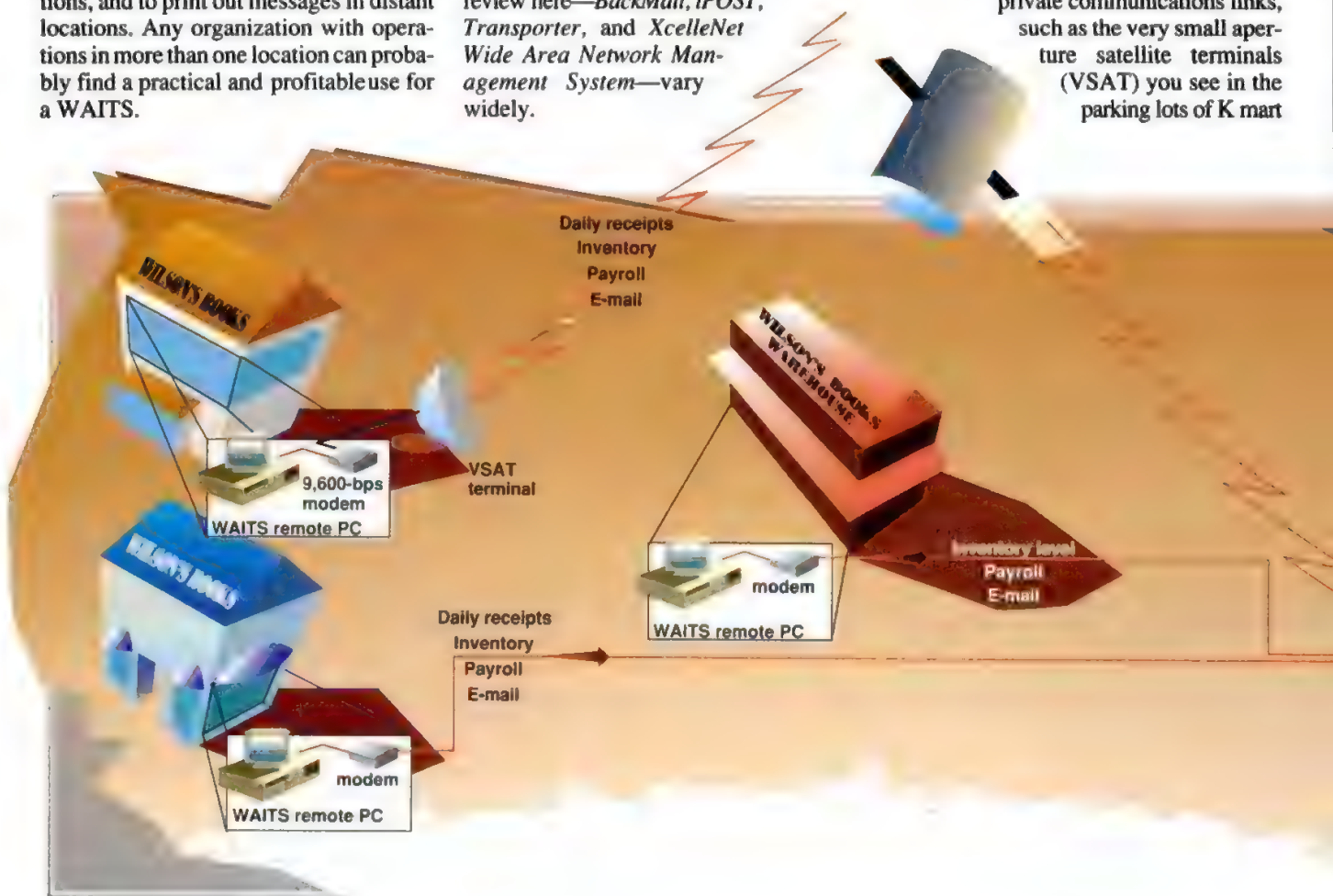
Today, the WAITS market is competitive and dynamic. The design, features, and support of the products we review here—*BackMail*, *tPOST*, *Transporter*, and *XcelleNet* Wide Area Network Management System—vary widely.

XcelleNet and *tPOST* are the leading products in this arena. The former is an industrial-strength WAN (Wide Area Network) operation and management system; an *XcelleNet* network management station was designed with large, busy file transfer networks in mind. *tPOST* puts more emphasis on electronic mail and offers fewer overall features. *BackMail*, a shareware product, offers surprising capabilities centering on electronic mail for a very low price. And while *Transporter*—a product marketed several years before its time—now shows its age, it is still useful, particularly in the file transfer area.

DIFFERENT STRUCTURES, DIFFICULT COMPARISONS

Automated and unattended operation is key to the WAITS concept. Typically, these systems contact each other and move information at scheduled times, although most allow the option of simply moving files when they are ready. They usually connect over dial-up telephone lines, but

it's easy to configure *XcelleNet* for private communications links, such as the very small aperture satellite terminals (VSAT) you see in the parking lots of K mart



and other national chain stores. All WAITS products use computer-to-computer file transfers, however, and *tPOST* can also send reports out by fax.

The products differ somewhat in the design of the wide area network each creates. *BackMail* and *Transporter* use a network of peer-to-peer systems. All nodes in the network are equal, and each person managing a node makes decisions about its actions. Nodes usually connect to each other directly to exchange files without an intermediate relay. *tPOST* has more of a centralized structure, with one or more master nodes that collect files from, as well as relay and send information to, subordinate nodes; it also has node-to-node capabilities.

XcelleNet is highly centralized, with OS/2-based multitasking master stations interrogating and controlling remote nodes running under any of several operating

systems. For really big operations, multiple *XcelleNet* master stations can coordinate their operations across a local area network.

Because these systems have different structures, it is difficult to compare their costs. *BackMail* is \$30 per node for any number of nodes. *tPOST* is about \$80 per node in a 100-node network, but the price for *tPOST* climbs to about \$150 per node for ten nodes, depending on the way your system is set up. *Transporter* includes the *Crosstalk XVI* communications package, and the set sells for \$295 per node. A 100-node *XcelleNet* network costs about \$340 per node to set up, but because the centralized management software is expensive, the price-per-node is much higher for smaller systems.

All these WAITS are easy to install and

operate. Installing the DOS-based systems simply involves copying a disk and running through a setup menu. *XcelleNet* is a more complex program that takes longer to install under OS/2, but all the operations use the Presentation Manager interface. A mouse isn't a requirement for *XcelleNet*, but it certainly makes selections easier. Both *XcelleNet* and *BackMail* provide background-mode operation for DOS-based PCs.

Consider wide area information transfer systems as economical alternatives to local area network bridges. They work within private-line voice-and-data communications networks, but installing a WAITS using dial-up lines could actually eliminate the necessity of a private-line network in some organizations. If you need to move information just across the street or all the way across an ocean, it's worth the WAITS.

WIDE AREA INFORMATION TRANSFER: HOW IT WORKS

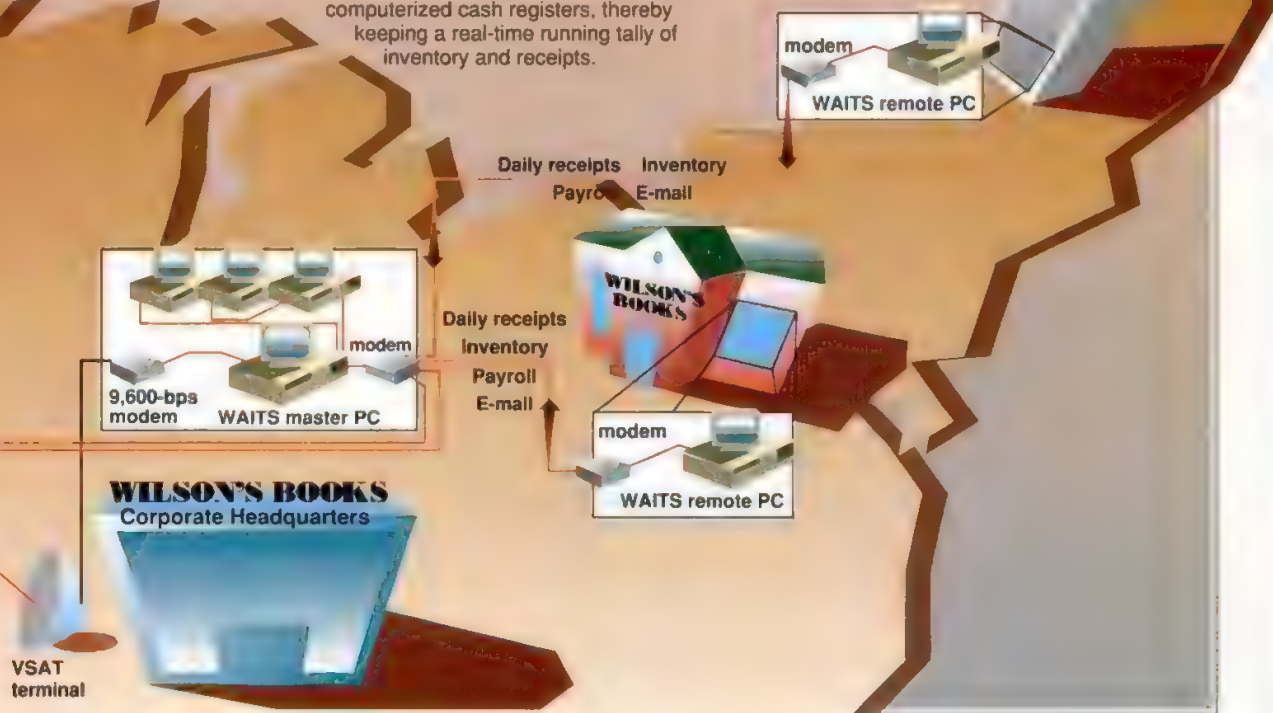
This diagram shows a nationwide WAITS network connecting four bookstores with their corporate headquarters office in the South. In this particular scheme, a controlling PC on the headquarters LAN interrogates the PCs located in the retail sales locations over satellite links and modems. The very small aperture (VSAT) satellite terminals use standard 9,600-bit-per-second modems. Dial-up telephone

lines, with lower cost/connection-time ratios, are used for most of this chain's communications.

The headquarters system receives daily receipt, inventory, and payroll information, as well as e-mail messages from its retail locations, and sends completed reports and e-mail instructions back out. The system also monitors inventory levels at the warehouse and forwards orders from the retail outlets.

Some systems can connect right into computerized cash registers, thereby keeping a real-time running tally of inventory and receipts.

The WAITS products we reviewed provide the software to link locations together via the controlling PC. Modems and communications links are not included in the prices per node quoted by the software vendors.



BackMail

All reviews by Mike Byrd

Unattended file transfer and e-mail capabilities are available at a low cost via Alethic Software's *BackMail* shareware program. At only \$30 per node, Version 1.1 of this memory-resident software can send and receive files, programs, and messages while your PC is busy doing other things.

BackMail is a small program, taking up only 35K of RAM. A hotkey brings up the front end, where you can create, read, and send information and monitor its flow. The program can be removed from RAM or its operation suspended with a few keystrokes. For some operations, *BackMail* boasts both attended and unattended modes.

SPREADING THE WORD

BackMail is a node-to-node system. Any *BackMail* node can send memos, records, and files to any other *BackMail* node over ordinary phone lines and standard modems operating at up to 9,600 bits per second. You can forward letters, reply to messages, do bulk mailings, and send or receive information in any file format. Each node's mailing list can contain over 1,000 different phone numbers including internal lines, local exchanges, and multiple long distance services.

For message creation, *BackMail* has a full-screen text editor (the maximum message size is 3.5K) complete with word wrap, full cursor movement, and help screens. Outgoing messages receive an identifying tag containing a 40-character subject

CONNECTIVITY WAITS

line, letterhead, time the message was composed, and forwarding and reply history. You can easily address individual messages to up to 100 different destinations by a point-and-shoot menu list of directory names, or messages can be bulk-mailed to all local or internal numbers.

Each user of the program declares a time when *BackMail* will be on-line and available. Communicating *BackMail* users track each destination's availability and schedule calls accordingly—all without operator intervention. *BackMail* automatically retries data calls if the destination is busy.

BackMail also includes an auto-dialer for voice calls. A user-definable hotkey presents all voice numbers in the *BackMail* directory. Each entry records and auto-dials appropriate dialing suffixes and prefixes (long distance, local, credit card, and so on).

By scheduling *BackMail*'s availability for nonbusiness hours, voice communications operate normally during business hours. If a voice call comes in during *BackMail*'s availability time, the program answers the line with the familiar carrier tone. If it doesn't detect a data connection after 6 seconds, the program determines that it is a voice call and alerts you to this.

BackMail does not compromise the security of your PC. It won't deliver a message or a file to someone to whom it is not explicitly addressed. Callers and users identify themselves by their phone numbers (which are entered during registration)—user-defined extension numbers add an extra layer of security. This keeps thieves from being able to use

FACT FILE EDITOR'S CHOICE

BackMail, Version 1.1
Alethic Software Inc., 52
Parkhill Rd., Halifax,
N.S. B3P 4R5 Canada;
(902) 423-9860. (Also
available from bulletin
boards, information
services and PC
MagNet.)

List Price: \$30 per
node; printed manual, \$10.

Requires: Modem, DOS 2.0 or later.

In Short: *BackMail* is a shareware
unattended-information-transfer
communication program offering tremendous
potential to private as well as corporate users.
Easy to install and use, it allows utilization of
other programs while providing automated file
and message transfers in the background. It's
much less expensive than any of the
competition.

CIRCLE 405 ON READER SERVICE CARD

your public phone number as an identifier to download or upload messages and files.

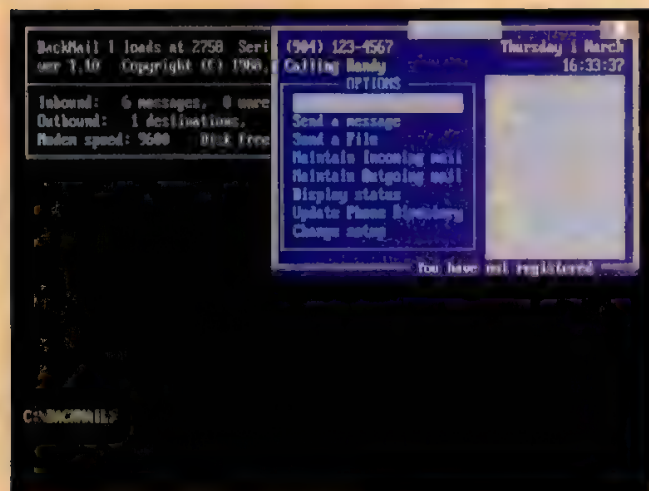
INSTALLATION

BackMail comes on a single 5.25-inch disk and is easy to install. The configuration program asks a few easy questions about your serial port, modem, monitor, and subdirectories. The default answers for the questions are appropriate for most installations.

The setup menu gives you extensive control of the program's parameters: you specify your availability time, the maximum number of telephone retries you'd like, and whether the program is being used on a data or voice plus data number.

Since *BackMail* is shareware, unregistered users are reminded about once a session to register their copies. Each time the message is ignored, the system whines at you for 22 seconds. The neat part about registration is that it's completely automatic—just hit a key and fill out an electronic form with credit card information. *BackMail* automatically validates this information, and you won't hear that whining noise again. (Since you are registering your *BackMail* phone number, changing to a different phone number requires you to reregister.)

Technical support for registered users is via voice or data lines. Alethic's data line is toll-free, and support is excellent. All the questions I asked were answered promptly (by return *BackMail* message) and accurately. What a delight to get technical support responses on Saturdays and Sundays!



Alethic Software's *BackMail* costs just \$30 per node and takes up just 35K when loaded as a TSR. It offers both attended and unattended file transfers.



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WIDE AREA INFORMATION TRANSFER SYSTEMS: SUMMARY OF FEATURES

Products listed in ascending price order

	BackMail	tPOST	Transporter	XcellaNet
List price	\$30 per node	\$129 per node; tPOST Central, \$229 per node	\$295 per node	\$11,995-\$16,995 x/Node, \$219 per node
OPERATING SYSTEMS SUPPORTED				
DOS	☒	☒	☒	☒
OS/2	☐	☐	☐	☒
Unix/Xenix	☐	☐	☐	☒
VMS	☐	☐	☐	☒
MESSAGE PREPARATION AND TRANSMISSION				
Message-reception TSR module (RAM required)	☒ (35K)	☐	☐	☒ (90K)
Message-creation TSR module (RAM required)	☒ (35K)	☐	☐	☒ (90K)
Text editor	☒	☒	☐	☒ †
Automatic line wrap	☒	☒	☐	☒ †
Non-ASCII message attachments	☐	☒	☐	☐
Message forwarding	☒	☒	☐	☒ †
Message reply	☒	☒	☐	☒ †
FILE PREPARATION AND TRANSMISSION				
Multiple file selection	☒	☒	☒	☒
Wide area distribution lists	☐	☒	☐	☒
Local distribution lists	☒	☒	☐	☐
Automatic display of directories and files	☒	☐	☐	☒
Time of transmission selectable	☒	☒	☒	☒
Calendar scheduling	☐	☐	☐	☒
Automatic retry after unsuccessful dial-up	☒	☒	☒	☒
Alternate phone line	☐	☐	☐	☒
Bidirectional comm transmission	☒	☒	☐	☒
FILE RECEPTION				
Transfer by filename	☒	☒	☒	☒
Directory selectable at receiving end	☐	☐	☐	☒
Updates data in background	☐	☐	☐	☒
OTHER				
Password exchange between both ends	☒	☒	☒	☒ †
Hardware security key	☐	☐	☐	☒
Data compression	☐	☐	☐	☒
Central distribution	☐	☒	☐	☒
Real-time status monitoring by administrator	☐	☒	☐ **	☒
Report generation	☐	☒	☒	☒
Multiple comm lines	☐	☒ (up to 4)	☐	☒ (up to 18)
9,600-bps operation	☒	☒	☐	☒

—Editor's Choice ☒—Yes ☐—No

*Nodes can communicate only with the central host.

**Transporter keeps a log of activity.

†These features are available through a single package costing \$2,495 plus \$150 per node.

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BackMail is simple to use and easy to like. It offers an information network capability that can be implemented by two people or 200, and its low price makes it an appealing contender in the WAITS arena. Be on the lookout for an upgraded version, *BackMail II*, in early 1990.

tPOST

Coker Electronics' *tPOST* administers a telecommunications network that can connect a far-flung empire through public phone lines. Using *tPOST*, branch and field offices can easily transfer files and exchange data with the home office or with each other.

The *tPOST* system consists of two main software components: *PC-tPOST* is a file-creation and telecommunications module; *tPOST Central* is a central message-handling facility that includes all the features of *PC-tPOST*. Configured for 100 nodes running *tPOST* and one central facility

CONNECTIVITY WAITS

using *tPOST Central*, this unattended file transfer program and host mail collection and distribution system lists at \$8,129. For an additional \$49 per node, you can add *tPOST Forms*, a utility for electronic forms processing. *tPOST* can also send purchase orders to your supplier's fax machines through an optional (\$129 per node) fax utility.

PC-tPOST and *tPOST Central* are not RAM-resident programs. However, since both really need to be operating full-time in the background to receive and transmit the appropriate messages and files, you'll need multitasking software like SoftLogic Solutions' *DoubledOS* or Quarterdeck Office Systems' *DESQview*. I tested *tPOST* with *DESQview*, Version 2.25, and found no installation or operation problems.

A WAY TO COMMUNICATE

tPOST is a snap to operate. The menus are clear and straightforward, a definite help for the novice user. Unfortunately, there



FACT FILE

tPOST, Version 3.1

Coker Electronics,
1430 Lexington Ave.,
San Mateo, CA 94402;
(415) 573-5515.

List Price: *PC-tPOST*, \$129 per node (if two or more are purchased, \$99; if 100 or more are purchased, \$79); *tPOST Central* (for use at the host), for one modem, \$229; *tPOST Multi-Line* for two modems, \$595; for four modems, \$895 (multimodem versions require 386-based PC); *tPOST FAXforward*, \$129; *tPOST Forms*, \$49; quantity pricing available.

Requires: *PC-tPOST*: 256K RAM, modem, DOS 2.0 or later; *tPOST Central*: 512K RAM, modem, DOS 2.0 or later; hard disk recommended; multimodem versions require multitasking software (such as *DESQview*).

In Short: A relatively inexpensive mail and file transfer system that's easy to use and maintain. It's most effective for automated transfers between remote sites.

CIRCLE 406 ON READER SERVICE CARD

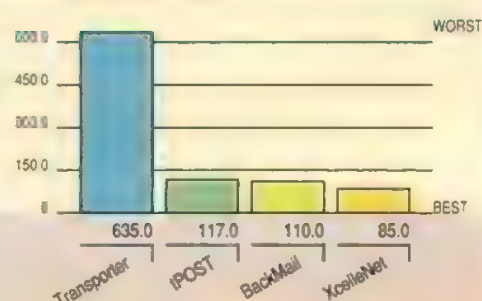
PERFORMANCE TESTS: WIDE AREA INFORMATION TRANSFER SYSTEMS

The only important time-critical feature of automated WAITS networks is the amount of time it takes them to transfer files. After all, file transfer time translates directly to long-distance communications charges. Among this group, *XcelleNet* is the clear speed champ.

WAITS File Transfer

Elapsed Time (seconds)

The WAITS File Transfer test measures the amount of time it takes to transfer a 62K file from a host to a remote PC. All tests are timed at the remote station from the time the modem answers the call to the time of disconnection. Hayes 9600 V.32 modems operating at 9,600 bps were used, except in the case of *Transporter*, which operates at a maximum speed of 1,200 bps.



WAITS efficiency shows up directly in telephone bills, particularly if your long-distance carrier bills you in 6-second increments. The speed differences among programs in these simple examples aren't great, but with hundreds of calls a month, a few seconds per call can make a big difference.

We repeatedly exchanged a set of compressible and noncompressible files

with each system to get an average time needed to exchange 62K of data.

Transporter is limited to 300- and 1,200-bit-per-second file transfer, so it was tested at 1,200 bits per second. This made an obvious difference in its ultimate throughput rate. But even if it could communicate at 9,600 bits per second, it wouldn't be able to catch *XcelleNet*, the fastest package.

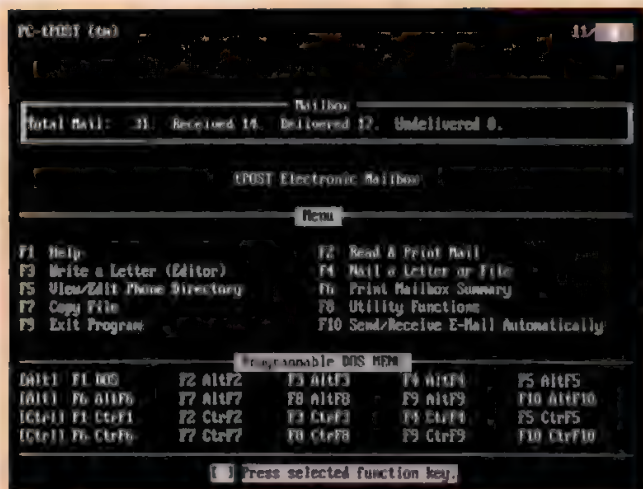
is no way for the more experienced user to speed up his tasks by bypassing some of these menus.

tPOST can be configured as either a private or public mailbox. A unique access ID is assigned to each private network mailbox. In a public network, *tPOST* accepts all incoming mail in a common area. In addition, *tPOST* sports a password-protected e-mail bulletin board.

tPOST makes it a breeze to compose, address, send, receive, and manage your e-mail. Messages can be composed with *tPOST*'s built-in editor or your own word processor. Addressees are selected individually from a phone directory list or in groups contained in distribution lists. Deliveries can be scheduled for any time—day or night—or left unscheduled. An activity log and incoming and outgoing mail are stored on-disk.

One of the pluses of the *tPOST* system is that you can transmit a single file to *tPOST Central* for subsequent distribution to multiple parties. You can also transfer text or binary files between any two *tPOST* stations for point-to-point delivery, or to *tPOST Central* for storage and remote mail collection.

Remote callers can deposit and automatically retrieve mail in a single call. A polling-mail collection option lets them request delivery of stored mail by return call to their preauthorized phone number. This feature is a data-security enhancement welcome to those users who store



tPOST, from Coker Electronics, assigns its features to function keys and lets you program Ctrl- and Alt-function-key combinations to repeat often-used command strings.

proprietary or sensitive mail.

Other features include batch mail processing in one phone call and call-limiting. The latter lets you specify the number of times the system should attempt to deliver the information to you before letting you know it's giving up, pending further instructions.

CENTRALIZED MESSAGE HANDLING

Incoming mail addressed to a host distribution list (stored in *tPOST Central*) is automatically distributed to addressees. This system gives all users up-to-date, centrally maintained distribution mailing lists while providing an efficient store-and-forward e-mail system.

tPOST Forms lets you design and complete business forms for any application and allows you to fill in stored business forms.

tPOST Central's automated mail management provides a versatile application interface, allowing the user to custom-program special functions. Users can write their own collection of mailbox-maintenance utilities or use DOS batch files; *tPOST Central* will periodically run

these, automatically and unattended.

Large networks consisting of regional *tPOST Centrals* can be installed. This setup can speed delivery and reduce long-distance phone charges—one message/file can be delivered to all selected *tPOST* stations by sending it to one regional *tPOST Central*, which then forwards it to other *tPOST Centrals* for local distribution.

FORMS PROCESSING

tPOST Forms lets you design and complete business forms for any application and allows you to fill in stored business forms. After completion, these forms can easily be transmitted via *tPOST* to a central location for subsequent processing. Data can be exported from completed forms to spreadsheet and database applications such as *Lotus 1-2-3* or *dBASE*.

The combination of *PC-tPOST* and the *tPOST Forms* package offers automated data collection from remote sites for analysis and computation at a central location. However, one problem that may occur is in the naming of transferred files. All files, whether e-mail or file transfers, gain a new name at the reception site in the form of MAILnnnn.IN (nnnn ranges from 0001 to 9999). An extra-cost utility can properly label transmitted files with the same filenames they had at the transmitting site.

INSTALLATION

The *tPOST* software installs in the time it takes to copy a floppy disk to your hard disk, and the reference manuals are comprehensive enough for even the most novice user. Especially worthwhile are the installation tips for *DoubleDOS* and *DESQview*.

Coker Electronics offers a 30-day money-back guarantee and free technical support for 120 days from the purchase date. Extended support is available through a purchase plan or by the hour. And unofficial *tPOST* user's groups sharing ideas, problems, and solutions are spread throughout the country (the company can help you find groups in your area).

If you have several locations you want to link up to share data and information, you'll find *tPOST* a relatively inexpensive and very effective choice.

Transporter

Transporter, launched by Crosstalk Communications in 1983, was one of the first low-end automated data communication systems for PCs. Currently including DCA's *Crosstalk XVI*, (the complete package lists at \$295 per node) *Transporter* remains a simple, easy-to-use unattended file transfer system.

Transporter gives you the flexibility of scheduling your unattended information transfers for when rates are cheapest. Your system needs at least 96K of free RAM, an auto-dial modem, and a standard asynchronous communications link. The system receiving your messages must have an auto-answer modem and *Transporter* (or a compatible communications program) installed. *Transporter* can also dial into a remote printer, allowing you to send or receive hard copies and share expensive printer resources.

TASK-BASED ENVIRONMENT

Transporter's current version (1.4) was released in 1985, and the documentation reflects its age. Reading it is like going through a time warp: hard disks are treated as rare items, a system clock is recommended, and all modems have external option switches that must be configured properly. However, the explanations are clear, precise, and complete.

The setup program (written in BASIC) requires you to have *BASICA* or *GW-BASIC*. It's not a problem, just a nuisance and another indication of this product's age. Setup tells the system which command port has your modem and sets a password for incoming calls; everything else is done from or by the main program.

Transporter is a breeze to operate. Its main (and only) menu allows creation and maintenance of its tasks. The tasks are the



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CONNECTIVITY WAITS



None of these **WAITS** programs has a particularly attractive interface, but why should they when most of their work is done unattended? *Transporter* offers all its functions in one menu.

core of the *Transporter* system; they include actions like send, receive, or print a file to or from another system. The date, time, phone number of the system to call, baud rate, filename, and a password (if needed) are included in the task. Phone numbers may be up to 36 characters long to allow use of MCI, Sprint, or other long-distance carriers.

You may create tasks as lists of single entities or form them into a library. To build a library, simply create a series of tasks and write them to disk. When you want to use them, merge them into the current task list you are creating. One nice

program can handle up to 80 separate tasks per call.

Once you've completed the task assignments, you merely tell *Transporter* to execute them. Each assigned task executes at the designated time. (Without an assigned task, the system will sit and wait in answer mode.) *Transporter* maintains a results log to show what it did while you were gone—it records the task number, time, date, filename, and the outcome of each task. You may print and delete the log following each session or allow it to accumulate over several sessions.

Function keys 1 to 5 are preset to aid in creating and editing the task list. You may customize the system to your needs by programming function keys 6 to 10.

In addition to accomplishing simple file transfer, *Transporter* can also act as a central host, moving files on a preset schedule, for a network of nodes running *Crosstalk* or a compatible communications system.

There is no charge for *Crosstalk*'s technical support, which is available from 8 A.M. to 8:30 P.M. Eastern time. Two bulletin boards are also available—(404) 541-1803 and (404) 998-8048.

Transporter's simplicity makes for a secure system—it won't do anything you haven't specifically told it to do. And callers are required to enter the proper password before being given permission to transfer a file either to or from your system.

Clearly, *Transporter* does not have all the features of up-to-date systems. However, if your file transfer needs are modest and you are not interested in the features



FACT FILE



Transporter Version 1.4

Crosstalk
Communications, 1000
Holcomb Woods
Pkwy., #440, Roswell,
GA 30076; (800) 241-
6393, (404) 998-3998.

List Price: \$295 per
node (includes *Crosstalk XVI*).

Requires: 96K RAM, modem, RS-232 serial
or Centronics asynchronous communications
interface, DOS 2.1 or later.

In Short: A simple automated file transfer
system for those with modest requirements.
Documentation is outdated but complete. The
program performs file transfer only, and is
best suited for organizations where
procedures are repetitive and requirements
change infrequently.

CIRCLE 407 ON READER SERVICE CARD

that other systems offer, its very simplicity becomes an asset.

XcelleNet Wide Area Network Management System

XcelleNet recently rolled out the *XcelleNet Wide Area Network Management System*. The system stands out for its ability to combine communications and network management, a mix previously available only for large corporations with leased lines and mainframes. Now, using this integrated, OS/2 Presentation Manager-based software, a nationwide WAN of hundreds of PCs can be managed through public dial-up telephone systems.

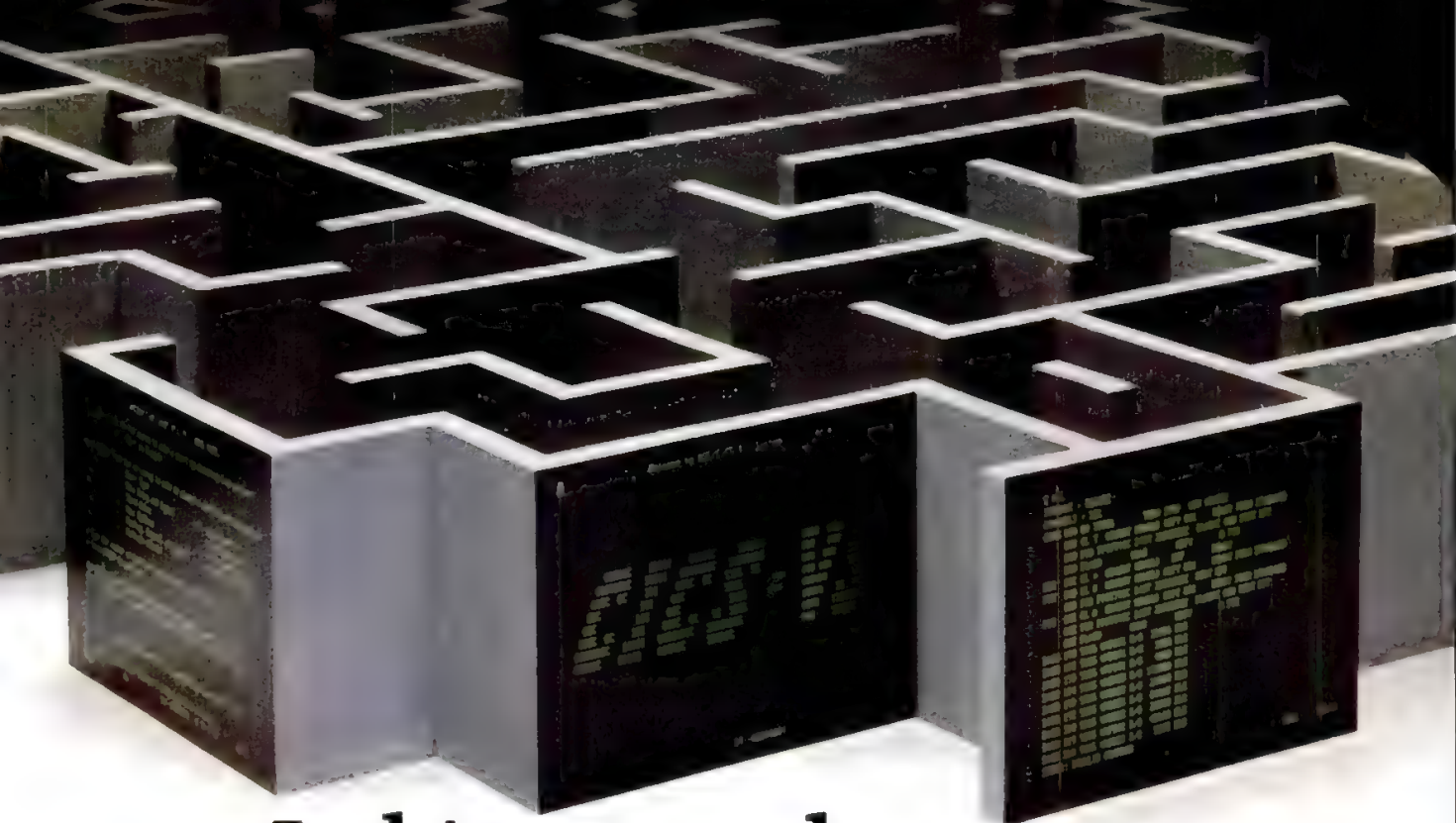
Aside from the modem component, *XcelleNet* (priced from \$11,995 to \$16,995 depending on the configuration) is all software; it requires no special equipment aside from what you need to run OS/2 and Presentation Manager on the central controlling PC. The remote software installs on any compatible and runs under DOS, OS/2, Xenix, and Unix. (Another remote software version supports Digital's MicroVAX and VAX processors under VMS.)

XcelleNet works with any telecommunications carrier and supports multiple interconnect methods, such as 800/WATS, X.25 packet networks, and shared hub VSATS (satellite terminals). You will also discover that new telecommunications options are easily integrated into your WAN setup.

***Transporter's*
simplicity makes for a
secure system—it
won't do anything you
haven't specifically
told it to do.**

feature is that the merge automatically sets the date on which the task was originally assigned to the current date.

Tasks with the same date, time, phone number, and baud rate can be connected; this lets *Transporter* perform several tasks on a single call rather than repetitively calling into the same system. The pro-



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CIRCLE 124 ON READER SERVICE CARD



FACT FILE

EDITOR'S CHOICE

XcelleNet Wide Area Network Management System

XcelleNet Inc., 1800 Century Blvd., #700, Atlanta, GA 30345; (404) 982-9900.

List Price: *Network Manager*, \$11,995 to \$16,995 (depending on configuration, up to 100 nodes); *X/Node*, \$219 per node; *X/Cluster*, \$8,995

Requires: *Network Manager*: 6MB RAM, 20- or 25-MHz 386-based PC with 100MB ESDI drive, VGA or EGA monitor, OS/2 Presentation Manager; *X/Node*: 640K RAM, modem, DOS 2.0.

In Short: A costly but extremely powerful system approach to achieving information transfer among geographically dispersed business locations. Easy to use and almost invisible to the remote user, it's a good choice for corporations and medium-size businesses.



CIRCLE 408 ON READER SERVICE CARD

TWO-MODULE SETUP

The system requires an administrator to work with the information being transferred. *XcelleNet* consists of two software modules: *X/Node* and *Network Manager*.

X/Node is the remote PC software. It automatically and transparently controls all communications tasks for the PC workstation, even while simultaneously running regular applications. *X/Node* loads into the background and remains almost invisible to the user, so personnel at remote locations really do not need communications training. The network administrator has the flexibility to connect to a remote PC at any time without disturbing routine node operations.

Network Manager, typically located at

corporate headquarters, is the central network-configuration and -management software. Running on a central multi-tasking computer, it is the heart of the *XcelleNet* system. Operating under Presentation Manager's graphical interface, *Network Manager* offers network security, automatic session scheduling and management, and error-detection and correction. It also provides data compression, electronic software distribution, checkpoint restarting of failed systems, an on-line network activity database, and a full complement of graphics-based diagnostic tools. Additionally, *Network Manager* provides secure two-way communications with mainframe systems.

The administrator sets up the entire network system by defining all the nodes, their characteristics and parameters, communication sessions, and even individual software—both communications and applications. *Network Manager's* graphical, menu-driven interface makes the system easy to learn and use. For most operations, the network administrator simply points and clicks with a mouse.

For instance, the administrator can schedule network activities (routine file transfers, new software distribution, and so on) to execute automatically at predetermined times on specified PCs on the network. For recurring tasks, the network administrator can define the frequency at which the event should occur, such as daily, or every 6 hours, or every Friday at 11:00 P.M.

Monitoring network performance is accomplished with the aid of *Network Manager's* detailed statistical database of

all network activity. Special filters and diagnostic tools aid in examination; the administrator can make use of this to identify the most cost-effective phone carriers, fine-tune network performance, and identify and repair network problems. De-

Network Manager

has a feature that allows you to automatically distribute software to remote nodes.

tailed screens tell at a glance the active ports and communications sessions. Visual alarms warn of any problems on the remote PCs, such as RAM shortages or hard disk capacity overload.

The administrator can also make use of a feature that allows automatic distribution of software to remote nodes. This feature makes for complete version and standardization control over the software running on each node.

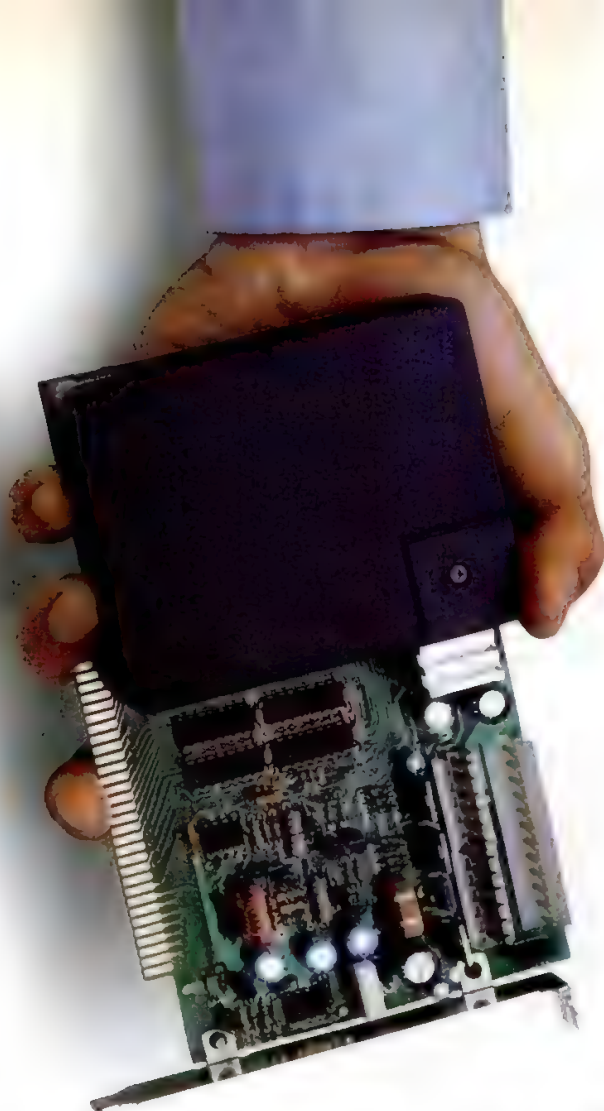
And the administrator can control telecommunication carriers. Each node has a primary and alternate communication carrier (MCI, AT&T, or Sprint, for example) from a pool of possible carriers. If the primary carrier has a problem connecting with a remote node, *Network Manager* reroutes the call through the specified alternate. (Remote PC users can activate a communications session from the node to *Network Manager* through a primary or alternate communications carrier.)

Network Manager can simultaneously handle up to 18 serial ports, each with its own modem and phone line. *Network Manager* also supports a number of third-party options for communicating with mainframes. These include LU 6.2-APPC communications across a Token-Ring network and basic file transfer utilities under several standard PC-to-mainframe protocols, such as 3270 and 5250.

X/Cluster is an extra-cost module that allows two or more 80386 PCs running *Network Manager* to operate in a local area network. This provides an effective expansion capability for added network



XcelleNet's main menu screen includes the program's function-key commands, the currently selected dial-out time, and a status window reporting the node to which you're dialing.



Introducing AccuCard.TM The only UPS that fits in your hand. And into your computer.

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Yet AccuCard provides enough DC battery power to automatically



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When the power comes back, built-in AccuSaverTM software will even automatically re-load your PC back

to precisely where it was. All system status, registers, buffers, memory, and data intact. Just as if nothing had happened.

The remarkable new AccuCard lists for only \$249. Yet it can save

your MS-DOS based PC data even when it's unattended. This may be the best insurance value you've ever seen.

AccuCard comes from the world's leading UPS supplier and is available through distributors and dealers near you. Just call 1-800-Back-UPS.

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Available through your local Distributor: Pioneer Technologies Group (800) 227-1693, Avnet Computer Technologies (800) 877-2226, RMA Microtech (800) 727-2957

CIRCLE 152 ON READER SERVICE CARD

V42

V42bis

2400 modems in the world can now perform like a 9600.

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What is already one of the best

dard for data compression. V.42bis. It's built into our new Hayes V-series® Smartmodem 2400™ to give it up to four-to-one throughput.

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handles like a dream.

That's because it's also equipped with V.42, the most dependable and compatible form of error-control available today.

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Think of it as the most affor



national standards, the V-series Smartmodem 2400 is compatible with MNP[®] error-control as well as MNP5 data compression.

So regardless of the modem technology you have been using,

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To find out the

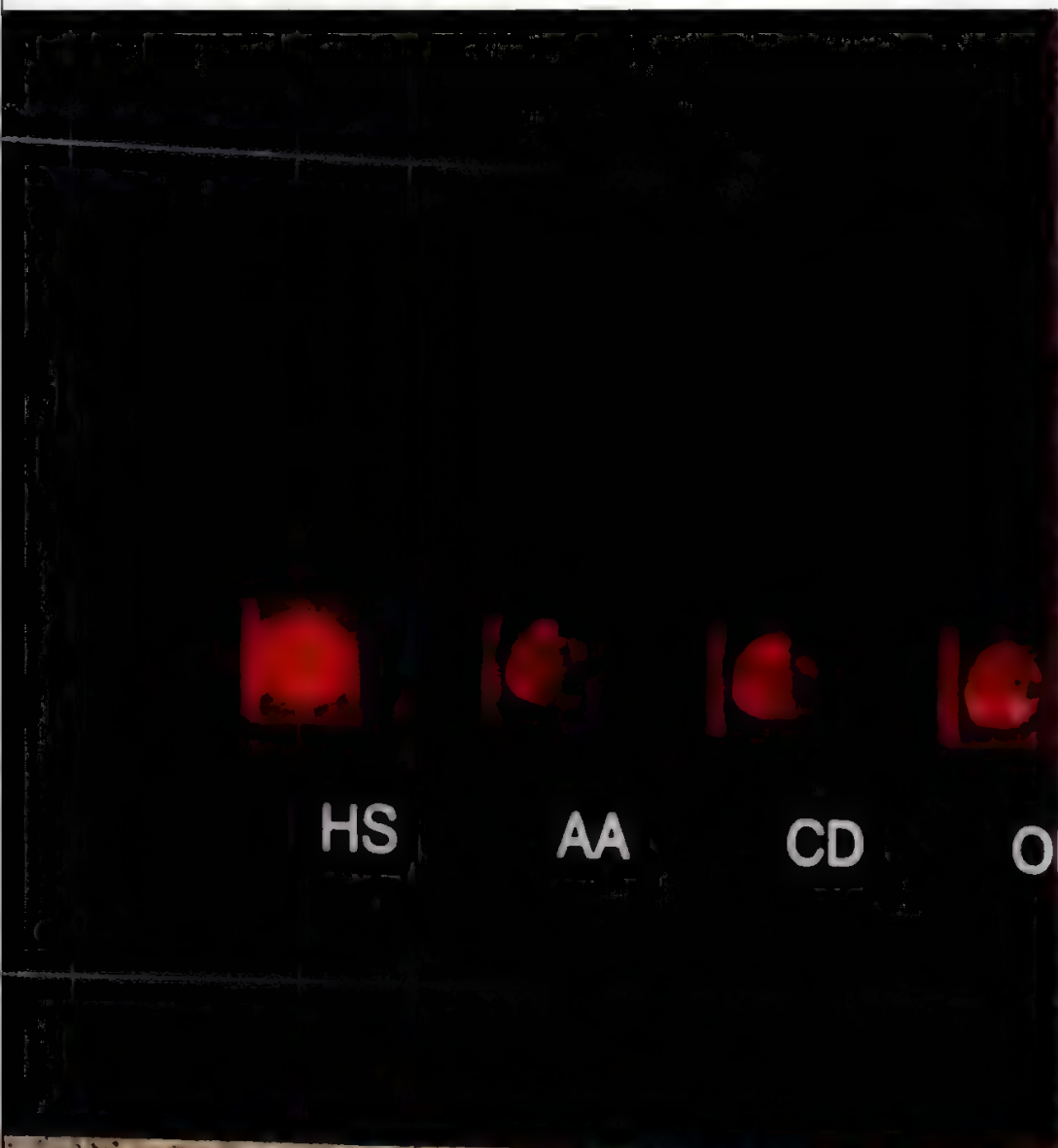
location of your nearest Hayes dealer, call 1-800-635-1225.

But hurry. This modem is going faster than ever.

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Our technology has the computer world talking. More than ever.
CIRCLE 136 ON READER SERVICE CARD

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EDITORS' CHOICE

- BackMail
- XcelleNet

All of these WAITS products perform well, but *XcelleNet* sets the standard. When ISDN communication becomes a widespread reality, *XcelleNet* will be ready. It is a near-effortless information-transfer system, especially at the remote end. Only the business headquarters location needs an expert user of the program, and that person's main job is simply to collate data. If *XcelleNet* is a forerunner of wide-area information-transfer programs to come, hang on. We're in for a fun ride.

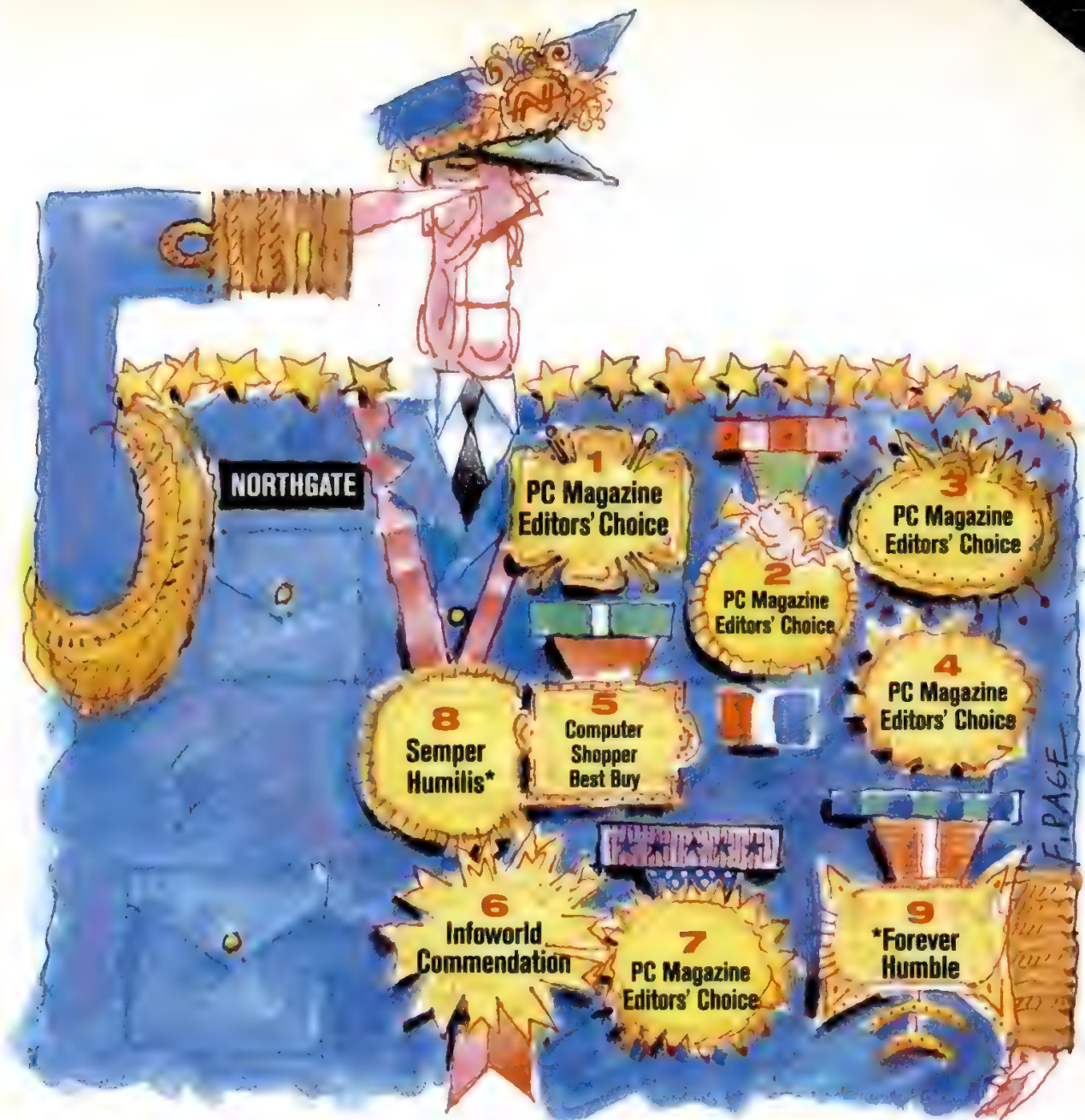
BackMail is intriguing, especially for its low cost—just \$30 per station. It's RAM resident, uses very little memory, and works efficiently for e-mail and unattended file transfers. It's worth consideration, especially for the small business user, but by no means is it as full-featured as *XcelleNet*.

processing power and communications ports. Should one of the *Network Manager* PCs fail, the network processing workload will automatically shift to other *Network Managers* on the network.

Network Manager users are required to purchase a 6-month technical-support service contract (cost dependent upon configuration) and an intensive two-day training session (\$2,000 for three persons). The training session covers OS/2 installation, *XcelleNet* installation, technical details, and implementation guidance. Technical support is available weekdays from 9 A.M. until 5 P.M. Eastern time.

The *XcelleNet System* is just that—a system. When you buy it you get a basic package that's ready to go, and optional applications fit right in. With all its bells and whistles, *XcelleNet* provides a friendly, reliable, and cost-effective means of moving time-sensitive information to and from geographically dispersed PCs. It's a must consideration for the corporate and medium-size business interested in wide-area information transfer systems. ■

Mike Byrd, a U.S. Air Force fighter pilot, holds master's degrees in engineering and computer science and is a division chief in a branch of the federal government that develops sophisticated electronics systems. Frank J. Derfler, Jr., is workgroup systems editor of PC Magazine.

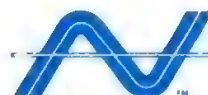


The Highly Decorated General Northgate

A bit pushy? Not at all. General George Patton would, on occasion, walk around with all of his medals in place. So would Generals Douglas MacArthur and Dwight D. Eisenhower when the spirit grabbed them.

And Samuel F.B. Morse, father of an earlier form of communications, before the world became computerized. (If you think we're making this up, check out Morse's be-medaled photo on the back page of this special Northgate insert.) In the meantime, we could go on and on with the reasons to buy a Northgate system, but we thought the awards said it better than we could.

1. PC Magazine "Editors' Choice" award: 80286 SuperMicro. (PC Magazine, January, 1989)
2. PC Magazine "Editors' Choice" award: 80386 Elegance 20 MHz. (PC Magazine, May, 1989)
3. PC Magazine "Editors' Choice" award: 80386 Elegance 25 MHz. (PC Magazine, May, 1989)
4. PC Magazine "Editors' Choice" award: 80386 Elegance 33 MHz. (PC Magazine, October, 1989)
5. Computer Shopper "Best Buy" awards, three years in a row, based on a vote of the magazine's readers. • Best Buy — complete computer system • Best Buy — overall (all products advertised in the magazine) • Best Buy — Input device: Northgate Omnikey Keyboard.
6. Infoworld. In April of 1989, they saluted Northgate's Elegance 386/25 with the headline: "The Elegance 3000 among the fastest 25-MHz systems" (Infoworld, April 10, 1989). In November, in their review of our Elegance 386/33, they said the following: "Northgate's Elegance 386-33/2000 computer is a top product in most of our scoring categories including value, where it earns just the second excellent mark we've awarded to 33 MHz systems." Overall rating 9.1, their highest ever.
7. PC Magazine "Editors' Choice" award: Northgate's Omnikey Keyboard. 8. "The Northgate Humility award" given to the most modest computer company in Plymouth Minnesota. So there you have it. And the year is still young. Northgate: "Semper Humilis." (Forever Humble).



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E l e g a n c e



PHOTO: HARRY LANGDON

THE NORTHGATE 386 33 MHZ ELEGANCE SYSTEM

- *“1a. Refinement and grace in movement, appearance or manners.
b. Tasteful opulence in form, decoration or presentation.
2. Something that is elegant.” (American Heritage Dictionary)

You said it.

Since at least three of the medals garnered by General Northgate were for our highly acclaimed Elegance series (triple Editors' Choice awards from PC Magazine, for example), we thought we'd show you what the machine looks like and give you a few specs in case you might be inclined to buy this elegantly designed state-of-the-art computer.

First of all, to photograph an elegant machine... you need an elegant photographer. So we went to the most highly respected lensman in Hollywood: Harry Langdon. He normally lights and shoots such famous faces as Linda Evans, Victoria Principal, Cher, Arnold Schwarzenegger and Diana Ross, to name just a few. So shooting a different pretty face like a Northgate Computer is all in a day's work for Harry. For one thing, Northgate doesn't need a hairdresser.

The Elegance series to your left comes in three versions: The 20 and 25 MHz models, and our top of the line/highest performance Elegance: the 33 MHz which earned a 9.1 rating in Infoworld.

The price of the complete 386™ 33 MHz Elegance system pictured: \$5995.00. (Of course, you can buy a fully configured Elegance system starting at \$3395.00.)

The only thing more impressive than the price is the tech support which comes along with our usual 1 year parts and labor warranty. Did we mention that we also ship you replacement parts, should they be needed, overnight at our expense?

And that our tech support people are actually here for you 24 hours a day, every day, every night?

Put us to the test: give us a call some night at midnight. Or 3:00 AM.

Now to the specs:

Technobabble*

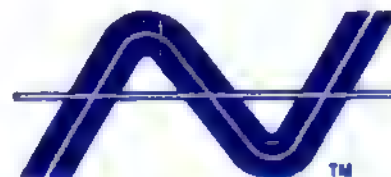
**Seemingly endless Technical specifications, without which you aren't about to buy this machine no matter how many awards it's won.*

Not only that... would this look like a real computer ad without them? Probably not. Here they are:

STANDARD CONFIGURATION

- ◆ 33 MHz Intel 80386 processor.
- ◆ 150 Mb ESDI Hard Drive 16MS.
- ◆ 4 Mb Ram.
- ◆ 64 K SRam Read-Writeback Cache (Optional 256 K Cache available)
- ◆ Zero wait state performance.
- ◆ 1.2 Mb—5.25" floppy drive (also reads, writes and formats low density diskettes).
- ◆ 1.44 Mb—3.5" floppy drive (also reads, writes and formats low density diskettes).
- ◆ Eight expansion card slots
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THE NORTHGATE OMNIKEY/PLUS

Keys have come a long way from the telegraph key to the Omnikey.

On May 24, 1844 Samuel F. B. Morse, father of the Telegraph, typed out the first message ever sent over a wire: "What Hath God Wrought?"

He didn't exactly type it. He tapped it.

Samuel F. B. was a great inventor, but he was working at a disadvantage; he only had one key. Think what might have happened if he'd had the full Omnikey Plus keyboard, pictured above?

He might have invented the Computer.

In the meantime, you may not realize that Northgate *did* invent a key of its own: the F-13 key, which we'll explain shortly.

This was recently pointed out by the Computer Editor of The New York Times, Peter H. Lewis, in the Jan. 2, 1990 edition. There, in The Science section, was a very nice review of Northgate's Omnikey, which carried the headline: A KEYBOARD WITH A DIFFERENCE.

Mr. Lewis told how he recently got his hands on Northgate's keyboard and, as a result, replaced his old "mushy keyboard...with the crisp Omnikey Plus."

"We like it a great deal," stated Lewis.

Two days into the nineties, and already Northgate's upstart Omnikey Plus, was getting raves from the N.Y. Times. In the laid-back, conservative style of The N.Y. Times, "we like it a great deal," may be considered a rave.

As long ago as August, 1988 a reviewer named Burton L. Alperson (Andrew Seybold's Outlook On Professional Computing) put it this way: "Northgate got it right. They have combined the best features of the I.B.M. keyboard layout with outstanding keyboard feedback. It's like coming home again, but better. In the first place, all the keys are where they should be...most important, all the function keys are back where they belong, on the left



TELEGRAPH KEY (CIRCA 1920)

side, in the same arrangement as the original PC keyboard.

As a point of reference, on a subjective 1-10 scale of mush to well defined feedback, I would rate the Compaq keyboard as a 1, an I.B.M. keyboard as an 8, and a Northgate Omnikey/102, as a 10."

What Hath Northgate Wrought?

So there you have it: Northgate up there right alongside Mary Lou Retton, a perfect 10.

Now to the previously celebrated F-13 key.

As Mr. Lewis pointed out in the Times, the F-13 key causes the period and comma keys to produce periods and commas in both upper and lower cases. No more shifting up and down stuff.

You might want to consider owning this extraordinary keyboard (in either of two models: The Omnikey/102, priced at \$99.00, or the Omnikey/Plus at \$119.00), which didn't arrive in time to help Mr. Morse. We are here to help *you*, however, 24 hours a day, seven days a week. Let's see them match that down at your

neighborhood computer store.

Just call 1-800-526-2446, and we'll tell you more about this amazing keyboard which comes with a 10-day, no questions asked, money-back guarantee and a three year unconditional warranty. Like General Northgate, Morse apparently liked to be photographed with all his hardware displayed, as you can see on the actual archival photo at left. That's nice.

Of course the Omnikey has won a few medals too. For example:

- PC Magazine "Editor's Choice": December, 1989.
- Computer Shopper Magazine "Best Buy," November, 1989.

It has also been declared the "Official keyboard of Chaos Manor" by Dr. Jerry Pournelle of Byte Magazine.

Why not make an Omnikey *your* official keyboard?

Just call Northgate and we'll take it from there.

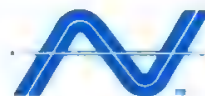
Medals shmedals. Once you plug in your new Omnikey, you'll find out what Northgate has wrought.



SAMUEL F.B. MORSE
(ONE KEY BUFF)



OMNIKEY 102 (CIRCA 1990)



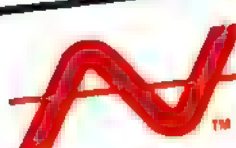
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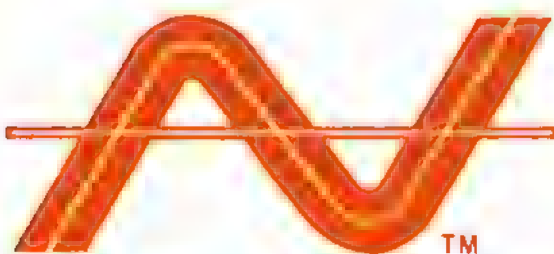
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- ☐ **INDIVIDUAL CREDIT**. Complete sections "a" and "b" only.

Please complete all appropriate sections, providing at least two year's residence and employment history. This will enable your application to be processed as quickly as possible. If you are self employed, please be sure to complete section "D".

Applicants must be 18 years of age or older.

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Requested Line of Credit \$

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Present Address: Street	Apt #	City	State	Zip	Home Phone () -		
Date of Residence: Month	Year	Monthly Payment: \$			Buy	Rent	Other
Previous Address:		Dates of Residence: From To					
Your Employer: (if self employed, see rear panel)		Date of Employment: Mo Yr		Position:	Monthly Income: Gross \$ Net \$		
Employer's Address: Street		City	State	Business Phone: () -			
Previous Employer:		Address:		Dates of Employment: From To			
Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation		Other Income: I have received since (Date)		Monthly Income Gross \$ Net \$			
Name and Address of Nearest Relative Not Living With You				Relationship			

b. Credit Information

Include joint applicant's information, if joint account requested

Bank Account:	Bank Name	Address	☐ Checking	☐ Savings
Bank Account:			☐ Checking	☐ Savings
Bank Loan Reference:			Payment	Balance
Bank Card Reference:	☐ VISA	☐ Mastercard		
Other Credit Card Reference:				
Other Credit References:	Account No	Expires		

c. Joint Applicant's Personal Information

If you are a married Wisconsin Applicant, you must provide your spouse's information below, even though your spouse may not be signing this contract

Joint Applicant's Name: First		Initial	Last	Date of Birth: Mo Day Yr		Social Security Number:	
Address: Street	Apt #	City	State	Zip	Home Phone () -		
Employer:		Date of Employment: Mo Yr		Position:	Monthly Income: Gross \$ Net \$		
Employer's Address: Street		City	State	Business Phone: () -			

d. Self-Employed Information

Complete this section only if you are self employed

Business Name		Proprietorship	Corporation	Partnership
Business Address		Business Telephone () -		
Description of Business	Your Position	In Business Since		
Your annual income from business	Business annual income (gross)	(net)		
You must provide at least one of the following:				
1. Business Name	Telephone () -	Personal Banker's Name		
2. Accountant's Name	Telephone () -			
3. Financial statement on business attached.				

PCM227

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by
M. David Stone

Lab Notes

More than any other kind of program, a word processor is best measured by its flexibility: the extent to which it lets you do things the way you want to, not the way its original programmer thought you ought to. By this measure, *Microsoft Word* rates very high. Its combination of macros and styles not only lets you customize specific operations to meet your needs, but gives you flexibility even in the way you go about the process of customizing.

It's not simply that *Word* lets you automate formatting either with macros or with styles. You can store your macros in one glossary file or many; you can give them a name, such as PrintPage or PP; and you can, as an option, attach them to your choice of a single control key, such as <ctrl p>, a control-key combination such as <ctrl p>p, or a function key. (Note: throughout this article, I'll follow the *Word* typographical conventions for designating keys and commands, not those generally used in *PC Magazine*.)

This flexibility is a two-edged sword. It will let you create what amounts to an entire alternate interface for *Word*. If you're not careful, however, it will also let you create a mix that winds up being more confusing than helpful. In short, the lack of an imposed structure leaves you with both the freedom and the need to create your own. In this Lab Notes, we'll look at these global structural issues as well as hints for constructing individual macros and styles. All comments are based on *Word* 5.0, though most apply to Version 4.0 as well.

MACROS AND STYLES—THE BASICS

Word stores its macros in *glossaries*, which are a special kind of file that the program loads independently of any text file. Similarly, it stores styles in *style sheets*—another special kind of file.

The strategy of glossaries and style sheets leads to some similarities in the mechanics of using macros and styles. When creating or modifying a macro, for example, you first save it to the glossary, after which you can save the glossary to disk,

Customizing Word's User Interface with Styles and Macros

■ With a little forethought, you can make Microsoft Word's flexible command structure reflect the way you actually think and work.

using the <esc> Transfer Glossary Save command. And when creating or modifying a style, you first save it to the style sheet, after which you can save the style sheet to disk with the <esc> Gallery Transfer Save command.

Because glossaries and style sheets are independent files, you can create as many of each as you like. If you have several individuals using *Word* on one system, you might create a different glossary for each user. Or, if you have a special project that needs unusual formatting, you might create a style sheet specifically for that project.

In general, however, you are best advised to stick with one glossary and one style sheet whenever possible. This eliminates possible problems of maintenance and consistency across multiple files. Unless otherwise stated, then, I'll assume that you're using only one glossary and one style sheet, NORMAL.GLY and NORMAL.STY, the default filenames that *Word* expects. I'll also assume that you'll keep both these files in the same directory as *Word*, where the program will look for and automatically load them.

Glossary entries—better known as macros—come in two varieties: keystroke and programmed. Keystroke macros store a sequence of keystrokes and play them back as if you were typing at the keyboard. Such macros can certainly be useful. But what really gives *Word* macros their power is their ability to incorporate programming logic. This yields macros that can implement commands, not just store keystrokes.

Word's programmed macros use a rather simple macro language. While very easy to master, it nonetheless provides enough flexibility to qualify as a programming language. The macro commands are identified by being enclosed between chevrons, <<like this>>. The left chevron is produced at the keyboard (in *Word*) by pressing the control key and the left square bracket. The right chevron is typed with the control key and right square bracket.

Word's macro commands are summarized in the table shown in Figure 1. Most fall into one of three categories: interactive commands, branching commands, and looping commands. Interactive commands cause the macro to stop, ask a question, and wait for an answer. For example, you can create a windowing macro that will ask whether to create a vertical or horizontal window. The question would take the form

```
ask Wintype=?Use (H)orizontal or  
(V)ertical windows?
```

Word will then set the value of the variable WINTYPE to match your answer.

Branching commands direct the macro

to do one thing or another, depending on your answer or some other variable. In the windowing macro discussed above, you could use a series of If statements to test the value of WINTYPE and determine what to do next. The commands would take the form

```

<[if wintype <> "H" and wintype <>
"V"]>.quit.<endif>
<[if wintype = "H"]>.XXXX.<endif>
<[if wintype = "V"]>.YYYY.<endif>

```

The first line (shown split into two lines to fit our column width) checks to see if you accidentally typed any key other than an H or a V. If so, the quit command ends the macro. Note how the AND operator lets you build a compound expression. Also note that the If statement is not case sensitive. Word treats upper- and lower-case answers as equivalents.

The XXXX and YYYY in the second and third lines above represent the commands that you want the macro to follow if the If statement on that line is true. In the second line, these would be the commands to open a horizontal window. In the third line, they would be the commands to open a vertical window.

By adding the <<else>> command, you can easily make the macro default to one kind of window or the other. To default to a horizontal window, for example, you need only change the three If statements to one:

```

<[if wintype = "V"]>
    YYYY
<else>
    XXXX
<endif>

```

This version uses a variation of the If statement to create a simple either/or choice for the macro. If you type a V, the macro will open a vertical window. If you type anything else—including an <enter> by itself—the macro will open a horizontal window.

Looping commands tell the macro to repeat an operation some number of times. In a windowing macro, you could have the macro ask how many windows to create. The macro would then step through the same set of windowing commands several times in order to match the number for which you ask. The looping commands for



MICROSOFT WORD MACRO COMMANDS

INTERACTIVE COMMANDS

Syntax: <<Ask variable=?Prompt>
or
<<Set variable=?Prompt>

Action: Stop, show the prompt on screen, wait for a response, and set the *variable* to match the response. The prompt is optional. The alternate form of Set is shown under Other Commands.

Syntax: <<Pause prompt>

Action: Stop, show the prompt on screen, and wait to let you interact directly with Word. You can use this command to stop and adjust a highlight selection manually, for example, or enter information in a command menu. The prompt is optional.

BRANCHING COMMANDS

Syntax: <<If condition>...<<Endif>

Action: Test whether the *condition* designated in the If statement is true. If so, perform the instructions between the If and Endif; if not, skip to the Endif. You can use the If statement to test the value of a variable, selection, or command field. By using multiple If statements, you can cascade from one to the next, testing for any of several values and performing different actions for each. You can also nest If statements without limit.

Syntax: <<If condition>...<<Else>...<<Endif>

Action: Create an either/or choice for macro control. If the *condition* designated in the If statement is true, perform the instructions between the If and Else, then skip to the Endif. If the condition is not true, skip to the Else and perform the instructions between the Else and Endif.

LOOPING COMMANDS

Syntax: <<While condition>...<<Endwhile>

Action: Keep repeating the instructions between the While and Endwhile as long as the *condition* designated in the While statement is true. When the *condition* is no longer true, go to the instructions after the Endwhile.

Syntax: <<Repeat n>...<<EndRepeat>

Action: Repeat the instructions between Repeat and Endrepeat *n* times. The *n* can be a variable, defined by a Set or Ask command.

OTHER COMMANDS

Syntax: <<Set variable=expression>

Action: Set the value of the *variable* equal to the *expression*. The expression can be a highlighted selection, a menu field, another variable, or some function of these. For example, the command: <<Set A = MID(A,1,1)> resets the value of the variable A equal to the first letter of the original value of A, so that a value of Yes would become Y.

Syntax: <<Quit>

Action: End the macro. This is often used in an If statement if a condition is not true. For example, you can test the answer to an Ask command and stop the macro if the answer is not one of the expected choices.

Syntax: <<Comment>...
or
<<Comment>...<<Endcomment>

Action: Ignore everything in the Comment statement, or everything between the Comment and Endcomment. Use this to enter explanatory notes within a macro.

Syntax: <<Message text>

Action: Show up to 80 characters of *text* on the screen. Useful for putting a message on the screen to let you know what the macro is doing when it isn't otherwise obvious.

Figure 1: All commands in Microsoft Word programmed macros are enclosed within left and right chevrons, which are created with Ctrl-[and Ctrl-], respectively.

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BYTE MAGAZINE SAYS...

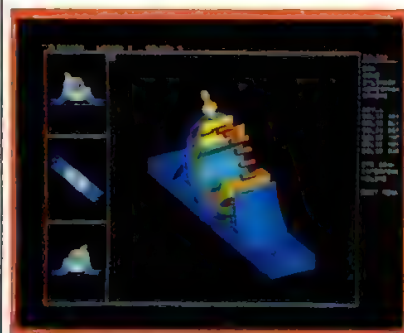
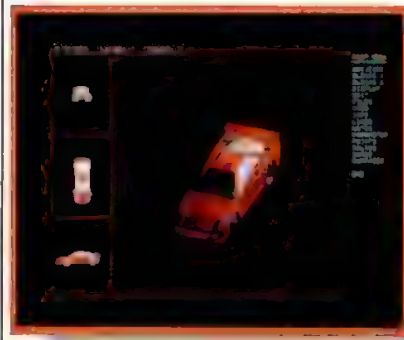
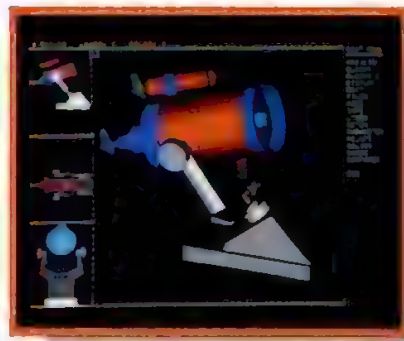
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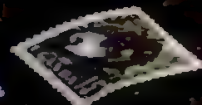
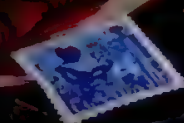
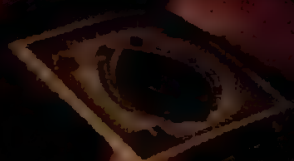


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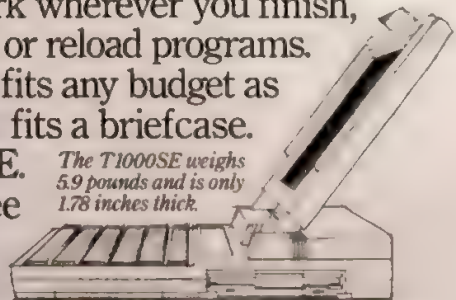
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Lab Notes

horizontal windows might take the form

```
ask winnum=?total number of
windows you want open?
set size=INT(24/winnum)
while winnum>1
  set winnum=winnum-1
  <esc>wsh=size;<tab>y<center>
endwhile
```

After asking for the number of windows you want open, this macro determines the size for each window by dividing the number of windows into an assumed 24 lines for the screen. It then sets the variable named SIZE equal to the window size. The INT function truncates the value to the next smaller integer. It is needed here because the <esc> Window Split Horizontal command in the next-to-last line will return an error message if the variable SIZE is not an integer.

Other functions in Word's macro programming language include the LEN function, which lets you determine the number of characters in a highlighted selection, menu field, or variable, and the MID function, which lets you extract a specified range of characters from a string. These are all discussed and illustrated in the sidebar "Microsoft Word Macro Functions."

The last four lines in the macro shown above constitute the actual loop. The While statement tells Word to continue the loop as long as the value of WINNUM is greater than 1. The Set statement decreases the value of WINNUM by 1 each time the macro goes through the loop. The next-to-last line uses the <esc> Window Split command to open a new window for each pass through the loop. The final line marks the end of the loop.

You might notice in passing how indenting the lines between the While and Endwhile commands helps to define the loop visually. This sort of formatting makes it much easier both to spot the While loop and to read it, an important consideration when you are trying to debug a macro or modify it.

STYLES VERSUS MACROS

Even among long-time users there is a tendency to think of Word styles simply as format-specific macros. This undervalues styles, which are one of Word's most potentially useful features. Probably the best

way to understand them is to compare the overall processes of formatting by macros and formatting by styles.

Word's menus and shortcut keys let you change margins, tabs, and other format commands item by item. Macros let you automate these changes so that you can give several format commands at once. Suppose, for example, that you want to create a keystroke macro to set the format for a numbered list. To do this you hit <shift F3> to start the macro Learn mode, then use the <esc> Format commands to set a .75-inch indent, with a first line of -.75 inches and a tab at .75 inches. You tap <shift F3> again to end the Learn mode, then enter an appropriate name—such as NumberedList—to which to copy it. To assign the macro to a control-key combination, you then enter a caret (on the same key as the 6 on the top row), and type the control-key combination to use. A good choice in this case would be <ctrl n>1. This way, the macro name will show on-screen as

NumberedList^<ctrl N>1

The macro you've thus created lets you set the indent, outdent, and tabs for a num-

bered list by placing the cursor highlight in the appropriate paragraphs and typing <ctrl N>1.

Superficially, styles work much the same way. To create a style for numbered lists, you go to the current style sheet with the <esc> Gallery command and choose Insert. You then enter an appropriate identifier—such as NL—in the key code field on the Insert screen, designate the level of format as Paragraph in the Usage field, and enter an appropriate comment—Numbered List would make sense in this case—in the Remark field. You then hit <enter> to insert the style. With the highlight still on the newly inserted style, you use the gallery's Format menus to define the indents and tabs. Finally, you choose the Exit command to go back to your text file.

You apply this newly defined style much as you would use the equivalent macro; that is, by placing the cursor highlight in the appropriate paragraph and typing <alt N>L. The resulting format will be the same as with the macro. However, styles differ from macros in that they let you change formats on a wholesale basis.

When you format a paragraph by shortcut key, menus, or a macro that uses ei-

MICROSOFT WORD MACRO FUNCTIONS

by M. David Stone

In addition to the command set shown in Figure 1, Word's macro programming language includes the functions explained below.

The INT function truncates a number to the next smallest integer. For example, the command

```
<Set SIZE = INT(24/num)>
```

ensures that SIZE will be an integer, even if the value of 24/num is not an integer. To round the value of SIZE properly, use the form

```
<Set SIZE = INT((24/num)+.5)>
```

The LEN function determines the length of a selection, field, or variable. You can use LEN(selection) to determine whether the cursor highlight is on only one character or extends to several. You can then use the result within a conditional statement to decide what the macro should do next.

The MID function lets you extract a specified range of characters from a text string. For example, when testing the answer to an Ask command, you may want to allow for both a single-letter response (Y or N) and a full-word response (Yes or No). You can do this with an If statement such as

```
<If MID(response,1,1) = "Y">
```

This will test the value of response, starting with the first letter (as instructed by the first 1) and continuing for a length of one letter (determined by the second 1).

In addition to these functions, you can manipulate strings by joining two or more together with the Set command. Use the form

```
<Set newstring = string1 string2>
```

As shown above, simply list the strings to be joined, inserting a single space between them. ■

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ther, *Word* attaches specific formatting information to the text. When you format by style, *Word* attaches the style, not the actual format. If you subsequently go back to your style sheet and change the format for any given style, the change will apply to every block of text that is marked with that style.

For example, suppose you have a 40-page report that contains some 15 numbered lists. After printing the report, you decide that those lists would really look better if a tab were moved by one-half inch. If the format is applied directly to the text, you'll have to search through the report, find each numbered list, and make the appropriate changes in the tab settings.

If your formatting is applied through style sheets, however, you need only go to the style sheet with the <esc> Gallery command and change the tab setting in the style. And if you decide you don't like the change after all, you can change the format back just as easily.

Be aware that there is a potential drawback to making global changes in this way. Any change that you make in a style will apply to every file that uses that style sheet—including files that were created with the old version of the style. And if you change a style for the sake of one document, you may find that you don't like the effects it has on some other documents.

If you rarely reprint old files, changes in styles won't be an important issue. However, you'll still want to guard against accidentally ruining the format for a heavily

formatted file. One way to do this is to create document-specific style sheets for those files you want to protect from future changes. An alternate strategy is to create document-specific style sheets just for the files to which you want to make changes.

In either case, the mechanics of creating a new style sheet are the same. Use the <esc> Gallery command to go to the style sheet, then save the current style sheet under a new name, using the Transfer Save command. When you Exit back to your

**Microsoft Word lets
you protect heavily
formatted files by
creating document-
specific style sheets
for only those files you
want to change.**

document, *Word* will automatically attach the newly saved style sheet.

Ultimately, of course, whether you prefer formatting by macros or by style sheets is largely a matter of personal taste. Styles are more-powerful tools than macros, but they demand more discipline. If you use styles for formatting some paragraphs and menus or speed keys for formatting others, you lose the advantage that styles provide: the ability to make global changes. Styles won't change anything that has been directly formatted.

If you can maintain the discipline consistently to use only styles for formatting, then they are well worth using. Otherwise stay with macros—or at least limit your use of styles to a specific set of formats with which you can comfortably maintain the needed discipline. You might, for example, decide to use styles for paragraph-level formats and direct formatting for character- and division-level formats.

STYLE SHEETS

Word will let you create styles for any of its three formatting levels. Paragraph styles let you specify the character format, tabs, border, position, and other usual settings shown on the Format Paragraph menu.

PC MAGAZINE MORE ON WORD

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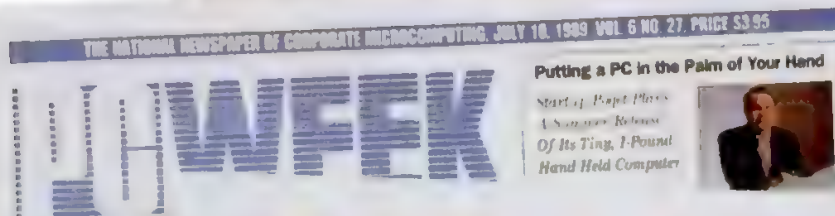


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Character styles offer the same formatting choices as the <esc> Format Character menu and apply to arbitrary blocks of text. Division styles offer the same formatting choices as the <esc> Format Division menus and apply to divisions.

You can create any of the three style levels in either of two ways. One choice is to go to the style sheet with the <esc> Gallery command, use the Insert command to insert a new style (you set the Usage field to character, paragraph, or division style, as appropriate) and then use the Gallery's Format menus to define the style.

Alternatively, from within your document, you can use *Word*'s direct formatting commands to format one or more characters, paragraphs, or divisions. With the cursor highlight on the formatted text, use the <esc> Format Stylesheet Record command or <alt F10>, enter an appropriate Key Code, Usage level, and Remark, and hit <enter> to record the style to the style sheet.

The procedure for using styles is essentially identical for all three levels. To attach a division or paragraph style to already existing text, make sure the cursor highlight is in the divisions or paragraphs to which you want to attach the style. For a character style, make sure the highlight extends over the entire block of text.

The fastest way to attach a style to the highlighted text is with a key code, typed as an Alt-key combination, such as <alt N>L. If you can't remember the key code, you can use the <esc> Format Stylesheet menu to get a list of Character, Paragraph, or Division styles. For example, the command

<esc>fap<F1>

will bring up a list of all the paragraph styles in the style sheet. And, of course, you can record this command to a macro to let you get the list with minimum keystrokes.

With the list on-screen, you can then attach the style to the currently highlighted paragraphs. Either type the key code or use the arrow keys or mouse to select the appropriate style and hit <enter>.

Beyond these basic mechanics, there are few absolutes: *Word* lets you customize its operations to match the way you

work. However, here are some suggestions that you may find useful in building your own style sheets.

First, if you're new to using style sheets, start with just two styles: a Division Standard and a Paragraph Standard (see Figure 2). *Word* will use these settings as your default format. The Division Standard sets the margins, page length, and other division format settings. The Paragraph Standard similarly sets the line spacing, indents, tabs, font, and font size.

With this as your starting point, create additional styles strictly on an as-needed basis. *Word* lets you create and store up to 74 paragraph styles, 22 division styles, and 29 character styles in any style sheet. This is more than you are likely to need. Yet it's tempting to fill up the list, wasting time by creating styles for formats that you'll never really use.

A related temptation is to create styles that have no functional meaning for the way you work. *Word* comes with several style sheets, one of which offers separate styles for every item of text in a letter. These include styles for Inside address, Return name and address, Author's name (below signature), Author's title (after name), Closing, Reference initials, and more.

If you format all of these items the same way—as left-flush, single-spaced paragraphs, for example—there is no reason to have a separate style for each kind of item. In fact, you may well be able to stay with the Standard Paragraph style throughout. On the other hand, if you do format different parts of letters differently, having separate styles makes sense. If you prefer to use a right-flush date line, for example, you

should create a date style.

Second, a good rule of thumb is to name styles to match their function rather than their format. If you use a bordered paragraph to highlight text, call it a Highlighted Note (HN) or Key Point (KP) style, not Border Paragraph (BP).

Here's the reason. You may have two kinds of text that demand highlight treatment: notes that stand apart from your text, like boxed inserts (sidebars) in a magazine article, and key points that are part of the body text but to which you want to draw the reader's eye. When you first define the two styles, you may use the same single-line border to highlight both kinds of text. Later, however, you may decide to differentiate the two.

If you started with a single style named after the format, such as Border Paragraph, you would then have to search through your file and attach a new style to one kind of paragraph or the other. But if you had named separate styles for separate functions—Highlighted Note and Key Point—and had attached the styles by function, changing the format becomes trivial. You have only to change one style or the other.

One important exception to the naming-by-function rule is for character styles. The *Word* manual itself suggests using speed keys for character formats even when you are otherwise using styles. And if you end up using a regular formatting speed key as part of a style key code—such as <alt b>I for Bibliography—*Word* even provides a command to let you get at the original <alt b> speed key. Just type <alt x>b, and the text will be directly formatted as bold. Remember, though, that if you

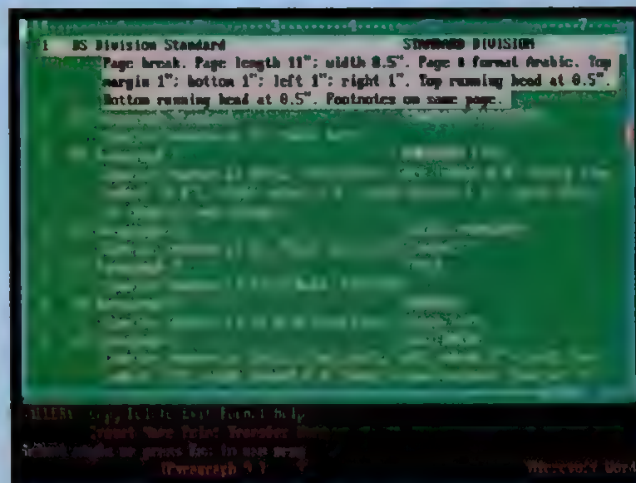


Figure 2: Note that each style in the style sheet is named after its function rather than its format.

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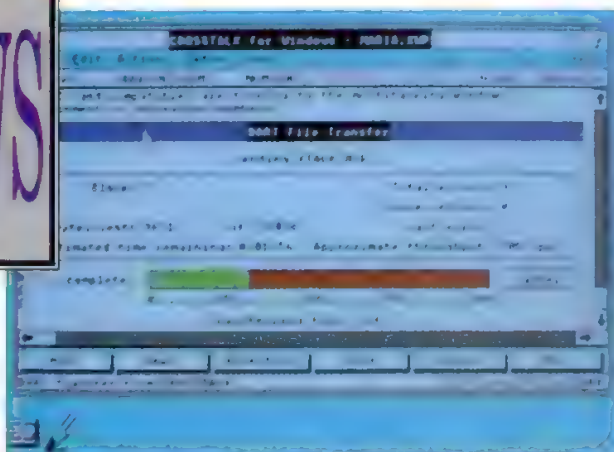
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Lab Notes

mix direct formatting with styles, you'll lose some of the value of using styles in the first place.

A good compromise is to *re-create* the character-format speed keys in character styles—using `<alt x>b` for the bold style, `<alt x>i` for the italic style, and so on. You can then use the same commands that you already know for specific formats such as boldface, and yet you will still be able to change those formats wholesale if you need to.

Note, however, that there is a limitation on your ability to use character styles this way. The styles define the *font* and *font size* of a character as well as the character enhancement. If you use the same font and font size throughout your document, this will not be an issue. However, if you use several fonts or font sizes, you would have to define a different version of each character style for each font. If you use multiple fonts, then, you may be forced to rely on direct formatting for character enhancement.

A second exception to the rule of naming styles by function concerns certain kinds of division styles. There are some format style decisions—such as using endnotes versus footnotes—for which you are likely to want to make wholesale substitution in your standard division, or which you may not need to consider at all in any given document. These are best named for the format.

A final suggestion for using style sheets is that many times you may wish to do without division styles altogether. Most of the time, you'll have only one division, so that changing the format globally is just as easy with direct formatting as with styles. Even so, it's useful to have a set of division styles that match your most common needs. For example, you might have one division style for letters, another division style for reports (using different margins), and a third for envelopes.

MACROS

Word's macro feature is arguably the best of any leading word processor. The credit goes partly to Word's macro commands and partly to Word's flexibility in naming macros—a point to which I'll return later. But just as important as either of these features is the ease with which you can create and modify macros in Word.

Word gives you two basic ways of creating macros. You can tell the program to memorize your keystrokes in Learn mode, or you can write the macro as text, then highlight it and copy it to a glossary entry. And you can modify macros by inserting them in the edit screen and editing them just as you do with any other text.

The Learn mode makes it easy to create long keystroke macros quickly. For example, suppose you want to implement a print macro that will set all printer options to your preferred settings, then stop to let you confirm or change the settings before printing.

The easy way to create such a macro is to turn on the Learn feature with `<shift F3>`. Then use the `<esc>` Printer Options command to go to the Printer Options screen and tab your way through the options, setting each one to taste. Be sure to set *every* item, even those that are currently set correctly. End the macro with the highlight in whatever field you are most likely to change most often (number of copies is a good choice). Then hit `<shift F3>` again to end the macro. When Word asks for a name to copy to, type an appropriate name, such as Print, and hit `<enter>`.

Now try bringing the macro into the editing screen by typing its name, followed by a caret (as in `print ^`), and hitting `<F3>`. The macro should look something like that shown in Figure 3: a single paragraph of largely unreadable text. Some details will vary; in particular, your printer name and model are likely to differ. You can now fix any typing errors, and you should break the macro into lines to make it more readable.

You'll also want to change the `<esc>` at the beginning of the macro to `<ctrl esc>`. If you ultimately assign the macro to a function-key or control-key combination, this step ensures that the macro will go to the command menu even if you start it from within the menu rather than from the editing screen. You may also want to

SAMPLE PRINT MACRO

```
<esc>pocanon8-3<tab>lpt1:<tab>
canon<space>lbp<space>8iii<tab>
150<tab>1<tab>n<tab>n<tab>n<tab>a
<tab>2>y<tab>y<tab>continuous<tab>
n<tab><down 2>
```

Figure 3: This sample Print macro, created with Word's Learn mode, can serve as the starting point for building any number of print macros.

add some comment lines, which will make it easier to identify the settings that you may want to modify for related macros. When you're finished, the macro should appear much more readable, like the one shown in Figure 4. To copy it back to the

REFORMATTED PRINT MACRO

```
<ctrl esc>pocanon8-3
<tab>lpt1:
<tab>canon<space>lbp<space>8iii
<tab>150
*comment: Set number of Copies*
<tab>1
<tab>n
<tab>n
<tab>n
*comment: set Range*<tab>a
<tab>2>y
<tab>y
<tab>continuous
<tab>n
<tab><down 2>
```

Figure 4: This listing is essentially the same keystroke macro shown in Figure 2. The macro has been reformatted for readability, however, and comments have been added to identify the two fields that are most likely to change when you are creating related macros.

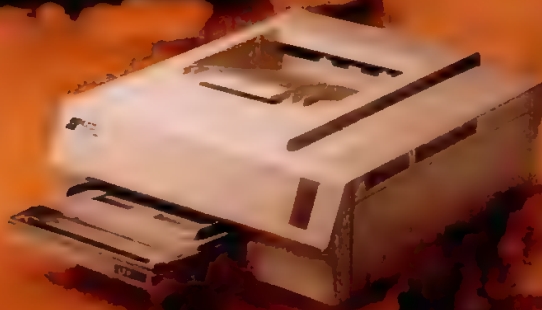
glossary, just highlight the macro and use the `<esc>` Copy command.

Once you've created this macro, you can easily create any number of variations on it. For a macro that prints without pausing at the options screen, for example, simply add `<enter 2>` at the end of the macro. For a version that prints the current selection, go to the line that sets the Range (indicated in Figure 4 with a comment line), and change the A, for All, to S, for Selection. For a macro that will print a range of pages, change the A to P, for Pages, and change the macro so it ends with the highlight in the Page Numbers field.

When creating a programmed macro, the only way to enter the macro commands is by typing them in Word's editing screen. Even then, however, you may find it useful to start with the Learn mode.

For example, suppose you want an envelope-printing macro. As part of that macro, you want Word to change the printer option to the landscape driver for your laser printer, print the envelope, then reset the printer option for portrait printing. However, if you use different sets of fonts—and different drivers—for various documents, make sure that Word resets the driver to the same one you started with. If you create the macro with the Learn mode, then bring it into the editing screen and clean it up a bit, the relevant section of the

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Lab Notes

macro might look like this:

```
<esc>po
hplasi<tab 2>
<down 3><enter><enter>
<esc>po<tab 2><down
3><enter><esc>
```

The first two lines set the Printer option to the landscape driver for the HP LaserJet. The third line sets the Range field to Selection. The final line (shown as two lines of type in order to fit within the magazine's column width) resets the Printer option to one of the LaserJet drivers, resets the Range option to All, and returns to the editing screen.

Once you've created the keystroke macro in the Learn mode, you can then add the macro commands. In this case, you would add a new line between the first and second lines:

```
<set curprn=field>
```

And you would change the last (split) line to

```
<esc>po<curprn><tab 2><down
3><enter><esc>
```

The new line sets the variable CURPRN to match the current printer driver. The modified last line uses the variable CURPRN to set *Word* for the driver with which you began rather than any specific driver. One lesson to learn here is that you can create a variable to store the original value of a field and then read that value back into the field when the macro finishes its task. Another lesson is that it's easier to add commands to a macro produced by Learn mode than to type the entire macro from scratch.

REDESIGNING THE FUNCTION KEYS

If you like programs that use function keys, you probably love the idea of having 40 or so function-key commands available in *Word*. Even if you find function-key commands convenient, however, you may well disagree with Microsoft's choices of which commands should be where. And if you're like me, you occasionally hit the wrong key and wish you had a way to take it back.

For example, it's distressingly easy to

tap <ctrl F8> to print when you meant to hit <shift F8> to highlight a sentence. This mistake is especially hard to avoid if you type on more than one keyboard, with the control key in a different position on each. Fortunately, *Word* makes it easy to redefine the function-key commands if you don't like them. The procedure is similar to assigning a macro to a control-key combination. When you name the macro, just add a caret after the name, followed by the function key of your choice. To assign a macro to <shift F10>, for example, type the caret, then hold down the shift key and tap <F10>.

As shipped, several of *Word*'s function keys are sorely lacking in error trapping. For example, you might want to redefine <ctrl F8> as

```
<ctrl esc><esc>
ask do it=?Really Print Y/N
(Default is No)
if do it="Y"<esc>pp<endif>
```

This modified version stops to ask if you really do want to print. If you answer Yes, it prints the entire document. Any other answer returns you to the edit screen. Other good candidates for this kind of error trapping include the commands to start a spell check and to reformat a paragraph as a header or footer.

Note that you would get the same results in the macro above by replacing the <esc> Print Printer command with

```
<ctrl x><ctrl F8>
```

In this latter form, the <ctrl x> tells *Word* to use its original meaning for <ctrl F8>. However, the menu command is the preferred choice. It leaves you free to redefine <ctrl x> without worrying about destroying another macro's ability to work. (If you're an ex-*WordStar* user who wants to use <ctrl x> as part of the *WordStar* cursor-control diamond, that may be a decisive consideration.)

Alas, there are some function-key commands that aren't available on the menus. To highlight the entire document, for example, your only choice is <shift F10>. And since this usually loses your current position in the document, you may well want to add error trapping to guard against typing the key accidentally. If you do, <ctrl x> is the only way to get at the highlight document command.

As it should be becoming clear, before you write *any* macros that include func-

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Lab Notes

tion-key commands, you should first decide how you want to use `<ctrl x>`. You can use it either as a macro or as a *Word* command to use the factory-original meaning assigned to a function key. If you decide never to use it as the first key in a macro, then you should include the `<ctrl x>` whenever you call on a function key within a macro. Entering the `<ctrl x>` superfluously in the macro won't do any harm, and it will ensure that the macro continues to work even if you decide later to redefine the function key.

In addition to adding error trapping to the function keys, you may want to extend their features to better match the way you work. For example, as shipped, `<ctrl F7>` (used for loading a file) shows you only files that end in *Word's* default .DOC extension. If you prefer using extensions that indicate the nature of a document—.LET for letters, .MEM for memos, and so on—this command is near-

ly useless. However, you can easily redefine it thus:

```
<ctrl esc>tl*.*<F1>
```

This enhanced version will start the `<esc>` Transfer Load command, enter the wildcard characters *.* to look for any file at all, then enter the `<F1>` request to see a list. Note the use of `<ctrl esc>` to force the macro to the command menus, even if you called it up from within the menus. The modified version will work much like the original `<ctrl F7>` except that it will show you all the files in a given directory.

CUSTOM DESIGNING AN INTERFACE

The most extreme—or creative—approach to the function keys is to ignore some or all of *Word's* key assignments and create your own function-key commands from scratch. With this route, you'll essentially be building an alternative interface to the program. First, however, you must spend some time designing that interface. Try to establish patterns to the function-key assignments that will make them easy

(“intuitive”) to learn and use.

For example, *Word* uses the pattern

Previous Word	Next Word
Previous Paragraph	Next Paragraph

This pattern is implemented in the function-key assignments

```
<F7> <F8>  
<F9> <F10>
```

Personally, I find I need to highlight the previous and next sentences far more often than I need to highlight previous and next words, so I would prefer the pattern

Previous Sentence	Next Sentence
Previous Paragraph	Next Paragraph

Or, even better:

Previous Word	Next Word
Previous Sentence	Next Sentence
Previous Paragraph	Next Paragraph

This arrangement would naturally map

A STYLISH MACRO

by M. David Stone

In order to achieve real elegance in using styles, you really should take advantage of macros that will help you handle the styles and style sheets. Listed below is a useful macro that allows you to attach any level of style to your text by choosing it from a list. The macro will also serve to demonstrate the how and why of several important macro commands. Keep in mind that the line numbers shown are not part of the macro: they are included strictly for convenience in explaining the purpose of each line in the line notes that follow.

You would use this macro whenever you can't remember the key code for a particular style. Simply select the text to format and start the macro. To begin with, the macro will ask whether you want to attach a paragraph, character, or division style. Answer with a P, C, or D, or hit `<enter>` to accept the default, which is a paragraph style. The macro will then display a list of all styles of the chosen level on-screen, showing the key code, variant, and remark for each style. If all the selected text has the same style assigned for that

level, that style will be highlighted. Otherwise, the first style on the list will be highlighted. Move the highlight to the style you want to format with, and hit `<enter>`.

```
1. «set echo="off"»  
2. <ctrl esc><esc>  
3. «ask styletype=?Attach  
(P)aragraph, (C)haracter, or  
(D)ivision style? (Default is  
Paragraph)»  
4. «if styletype=""«set  
styletype="p"«endif»  
5. <esc>f«styletype»  
6. «set cursty=field»  
7. <F1>  
8. «if cursty<>""»  
9. «while field<>cursty»  
   <right>«endwhile»  
10. «endif»
```

LINE NOTES

1. This line sets echo to off so that the macro doesn't have to update the screen with each step. This lets it run slightly faster (particularly in line 9) than it otherwise would.

2. Next, we ensure that the macro

will start in edit mode, even if it was called up from within the menus.

3. This line asks which level style you want to look for.

4. This tests your answer to line 3. If you simply hit `<enter>`, it sets the variable STYLETYPE to p.

5. Line 5 goes to the Format Style-sheet menu command and from there chooses Paragraph, Character, or Division, depending on the current value of the variable STYLETYPE.

6. This line sets the variable CURSTY to match the currently assigned style, if there is one.

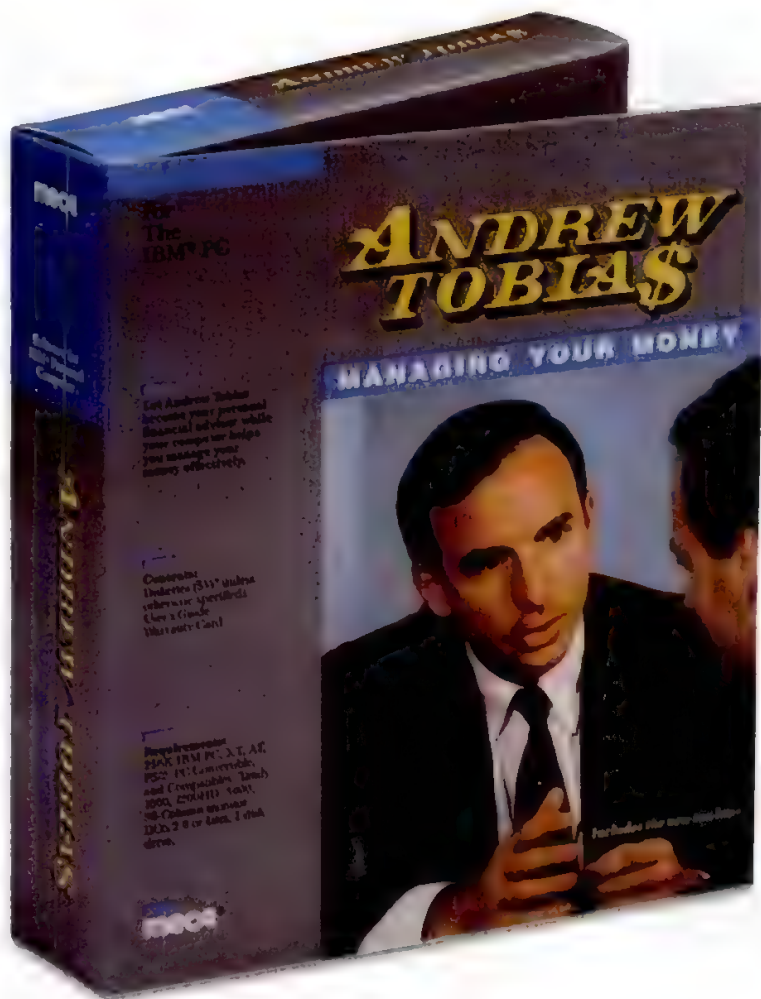
7. Line 7 requests a list of all styles for this level.

8. This line tests whether there is a currently assigned style at this level for the selected text. If there is, the macro continues with line 9. Otherwise it goes to line 10 and stops.

9. Line 9 moves through the list of styles, comparing each to CURSTY. When it finds a match the macro stops, leaving you at the list of styles with the current style highlighted.

10. This marks the end of the If statement begun in line 8. ■

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to the function keys as

<F5> <F6>
<F7> <F8>
<F9> <F10>

Or, on an extended keyboard, as

Word	Sentence	Paragraph
Prev Next	Prev Next	Prev Next
<F7> <F8>	<F9> <F10>	<F11> <F12>

This kind of pattern serves as a kind of kinesthetic mnemonic. In each pair, the left key moves back and the right key moves forward, and the pairs are in an ascending order. Other patterns link related commands to a specific key or nearby keys, or with the same shifted state. For example, you might put all formatting macros on F11 and F12, or you might create a set of windowing commands and attach each one to an Alt-function key. The point is to find a consistent approach that matches the way you work.

Word's flexibility in naming macros gives you another way of essentially designing your own interface. Here again, it's important to impose your own organizational structure. As with styles, there are few absolutes, but here are some rules of thumb I think you should consider seriously. These come from a longer list in my book, *Word Power Pack*, published by Brady.

First, pick a style for macro names and stick to it. This is strictly a matter of individual taste. Microsoft, for example, recommends ending each macro with .MAC so that you can easily distinguish macros from text entries. However, I've never confused my macros with text entries, so for me the .MAC extension is simply a call for unnecessary typing.

A similar issue arises from the underline character, which Microsoft uses as a separator between words. I find it clumsy and time-consuming to type the underline, and I have no trouble reading a macro that uses a cap as the first letter in each word. If you prefer using an underline, hyphen, or period as a separator, by all means go ahead. *Just be sure to be consistent.* Otherwise, you are guaranteed to be frustrated when you type PrintThis<F3> and nothing happens because that macro is called Print.This.

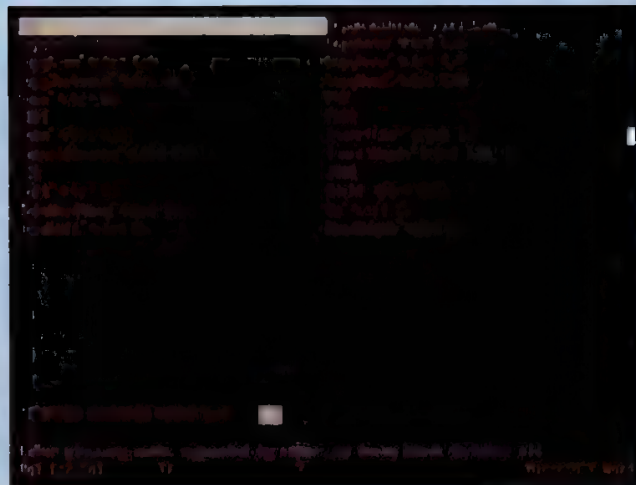


Figure 5: In this sample *Word* glossary, macros are grouped into family names—CopyCol, CopyLine, CopyPara, and so on. Note also the use of three-letter abbreviations such as FBK for Format Bookmark.

Another good rule is to group your macros into families and put the family names first, as shown in Figure 5. If you have several macros for printing, don't call them Selection, PagePrint, PrintAll, and Draft. Rather, call them PrintSelection, PrintPage, PrintAll, and PrintDraft. Grouping macros this way not only makes the names easier to remember but also makes the individual macros easier to find if you must use the <esc> Insert <F1> to search through your glossary. If you want a Print macro and you know the family name is Print, then you know where to look for it.

You can also use family groupings for control-key combinations. For example, you might restrict <ctrl p> to Print macros—(<ctrl p>s for PrintSelection, <ctrl p>p for Print Page, <ctrl p>a for PrintAll, and <ctrl p>d for PrintDraft.

Don't be lulled into using the <ctrl p> for some other mnemonic as well, such as Previous Division and Previous Page. If you try doubling up like this, later you will undoubtedly find conflicts in your mnemonics—which make them anything but mnemonic. Did you use <ctrl p>d for Previous Division or Print Draft? Even if you somehow avoid the doubling-up problem, you're opening the door to confusion.

Another temptation to avoid is getting carried away with control-key shortcuts. *Word* is unusual in letting you assign two-key control-key combinations to macros. That gives you the opportunity to create far more control-key shortcuts than you can possibly remember. Limit the shortcut keys to two cases: the macros you use often enough to guarantee you'll remember them, and those macros that you use re-

peatedly when you do use them.

Finally, you should be open to creating longer mnemonics when necessary. In cases where a two-key combination isn't long enough to provide a good mnemonic, don't force it. *Word* also has the ability to invoke macros by name. For example, if you use multiple windows a lot and you create a set of window-opening macros, you could use WH2 for two horizontal windows, WV4 for four vertical windows, and WH2V3 for two horizontal and three vertical windows.

PUTTING IT ALL TOGETHER

Word's approach to macros is filled with possibilities. Not only does the macro language let you add features to *Word*, but the choices in naming macros let you create a new command structure.

If you're an old *WordStar* user and miss the logic of its commands, you can re-create them in *Word* with control-key macros plus named macros for the dot commands. Similarly, you can also use the function keys to re-create the menu logic of *WordPerfect* or use named macros to re-create commands in *KyWrite*.

The macros presented here, as well as some others that may be useful, are available on PC MagNet. The information provided here should get you started in designing your own macros and style sheets. The most important point is that you can design commands to match the way you work. If you always thought you could design a better interface, *Word* gives you the chance to try. ■

M. David Stone is a contributing editor of PC Magazine.



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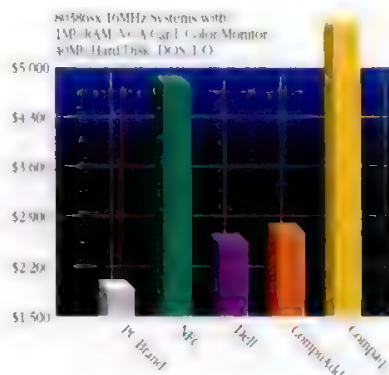
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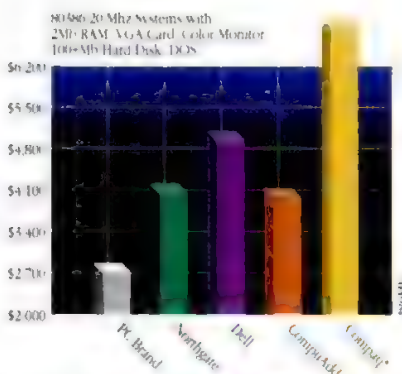
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InfoWorld, Product Review,
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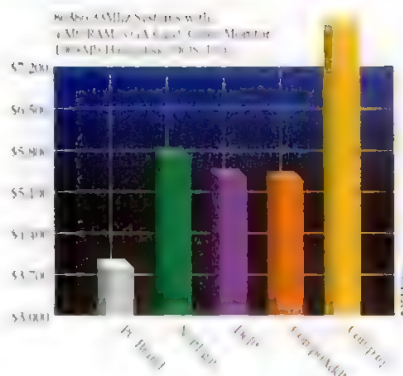
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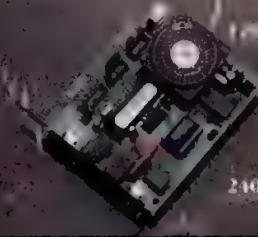
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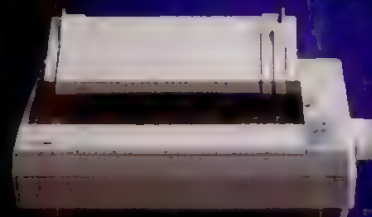


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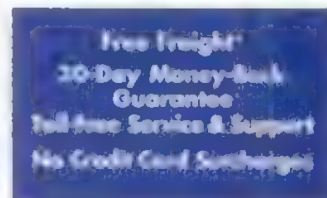
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by
Michael J. Mefford

Utilities

Most of us have to live by the book—the appointment book—and today, it's often more convenient to put the book in your PC rather than in your pocket. But even this approach leaves two problems unresolved. For one thing, conventional appointment schedulers let you see only a day or two at a time. So when you're on the phone and need to make a lunch date, you often have to flip through page after page before you and your caller can find an opening agreeable to all. The second problem is that it's easy to forget to look at your schedule when you get busy, and invariably you end up being late or missing your meetings anyway.

SCHEDULE.COM attacks both of these problems. Its first screen, shown in Figure 1, provides a fast monthly overview in which your commitments are blocked out in hourly increments. The top row of boxes for each day covers appointments from 6:00 A.M. through 1:30 P.M.; the bottom row covers 2:00 P.M. through 9:30 P.M. Simply by glancing at the top right square for March 13, you can see that you're busy at 1:00 P.M. (or 1:30 P.M., or both). While I could have programmed SCHEDULE to use different characters for half-hour intervals and kept the box symbol for a whole hour, I decided that

Track your Time and Appointments with SCHEDULE.COM

■ This issue's utility gives you both a monthly overview and a daily record (with an optional reminder chime) to make keeping track of your schedule a snap.

simplicity and less granularity were more important for an at-a-glance reference.

When you hit the Enter key, a second screen, like the one shown in Figure 2, appears for the highlighted day. Here you enter your appointments in half-hour intervals, supplemented by a three-line notepad at the bottom of the screen. Whenever SCHEDULE finds a character other than a space in an appointment time slot, it as-

sumes that you have something planned and puts the box character in the appropriate place on the calendar screen. This makes it easy to black out all time slots by alternately hitting a character and the Down Arrow for any days when you're not going to be in the office. And in accord with modern practice, you back out of SCHEDULE by hitting the Esc key—once to exit the monthly screen or twice to exit the daily screen.

You can use SCHEDULE either as a standalone or as a memory-resident utility. In the latter instance, you can also have the program automatically remind you—by chiming and popping up its appointment screen—when you've got something on the docket. No more missed appointments!

Instructions for downloading a ready-to-run copy of SCHEDULE from PC MagNet are given in the sidebar "SCHEDULE by Modem." Because of space considerations, we are not able to print the source code here. However, if you're interested in examining or modifying the program's source code, you can also download the file SCHEDULE.ASM from PC MagNet. Or you can get both the assembly and BASIC listings by mail or fax by sending a written request with your name, address and fax number (if applicable) to *PC Magazine Utilities*, One Park Avenue, New York, New York, 10016, Attention: Carolyn Falconer. (Note: estimated fax length is 45 pages.) No phone calls, please.

In order to assemble the SCHEDULE utility from its source code, you must use a macro assembler (IBM or Microsoft, Ver-



Figure 1: You can see at a glance how heavily you're booked on certain days and whether you're free at a certain hour just by consulting SCHEDULE's first screen.

Utilities

sion 2 or later) and enter the following commands:

```
MASH SCHEDULE;  
LINK SCHEDULE;  
EXE2BIN SCHEDULE SCHEDULE.COM
```

SCHEDULE SYNTAX

The full command syntax for SCHEDULE is as follows:

```
SCHEDULE [/I] [/U] [/Hn] [/Pn...n]  
[/G] [/A] [/C] [/M] [/B]
```

Entered without any of its optional switches, SCHEDULE operates as a standalone utility for entering, editing, saving, printing, and purging your appointments. If you run it with the optional /I parameter, either at the DOS command line or as part of your AUTOEXEC.BAT, SCHEDULE becomes memory-resident, occupying approximately 15K of RAM. When installed as a TSR, SCHEDULE will automatically (as a default) remind you of appointments by chiming and popping up its appointment screen at the appropriate time(s). It can be deinstalled by entering SCHEDULE/U if no other memory-resident application has been installed subsequently.

Since hotkey conflicts among TSRs and applications are so common, I provided the /H option to make it easy to change the key that pops up SCHEDULE. The default hotkey is Alt-C, but you can change it—even after installation—to any combination of Ctrl or Alt and any alphanumeric

key. To install SCHEDULE using Ctrl-S as its hotkey, for example, you would enter

```
SCHEDULE /I /H Ctrl.S
```

The /I switch tells SCHEDULE to install itself, and the /H switch tells it to use Ctrl-S as its hotkey. Note that when entering the command you type the *letters* Ctrl (or Alt); to execute the command thereafter you hit the appropriate key combination. Repeating the /I command is not necessary if SCHEDULE is already in memory. You can simply enter SCHEDULE again with /H and the newly designated hotkey and you'll update the already installed copy of the program.

The /P and /G command-line options affect SCHEDULE's printouts. From within the program, pressing F5 prints the monthly calendar or a day's appointments, depending on which of the two SCHEDULE screens is visible. The /Pn . . . n parameter allows you to enter a printer setup string of up to ten decimal printer codes (the values of n). For example, if you have a Hewlett-Packard LaserJet printer or compatible and you want the calendar or appointments printed in boldface, you would enter

```
SCHEDULE /P 27 40 115 66
```

As shown in Figures 1 and 2, both of SCHEDULE's printable screens use the IBM ASCII extended line-drawing characters. Since most printers can't handle these characters properly, however, SCHEDULE defaults to translating them into standard text characters (dash, vertical bar, plus sign, equals sign, and asterisk).

your printer *can* handle the line-drawing characters, you tell SCHEDULE to send them directly by adding the /G command-line switch. Note that some printers can be switched into an emulation mode that recognizes the IBM line-drawing characters. Check your printer manual and add these codes to the /P printer setup string along with the /G switch.

Since SCHEDULE is a text-based program, you can't bring it up over a graphics screen, such as that of *Microsoft Windows*. You'll get beeped if you try. Other times when SCHEDULE can't pop up on schedule (it will notify you that it can't with two short beeps) are when DOS is busy doing something else, when there is disk activity going on, or when you've already popped it up yourself to edit another day's appointments. Always exit SCHEDULE after editing to reenable its reminder features.

You can selectively cancel either of SCHEDULE's reminders. The /C switch turns off the appointment reminder chime to silence the program if the PC's speaker annoys you or nearby coworkers. Alternatively, the /A parameter disables the automatic appointment-page pop-up. You'd use this switch if the chime alone is a sufficient reminder and you don't want the screen on which you're working disturbed. A communication program is one application to which the /A switch may apply.

The /M switch option turns off the automatic Midnight pop-up that SCHEDULE uses to get the new day's events. Be sure to use this switch if you need to run a program overnight. Otherwise, when you come in the following morning you'll find SCHEDULE on the screen and your program frozen at the point it had reached at midnight.

The last switch, /B, forces SCHEDULE to use black-and-white attributes. Some color monitors only display eight colors, and some use color combinations that don't have proper contrast. This applies especially to portables with LCD screens. If you find that SCHEDULE is hard to read in color, you can use /B or you can customize SCHEDULE's colors with the instructions found in the sidebar "Customizing SCHEDULE."

If you forget the syntax for any of these commands, just enter SCHEDULE ? to display a helpful list.

Two additional notes are in order. First, if you install SCHEDULE as a TSR and you also use *SideKick*, be sure to install SCHEDULE before *SideKick*. That's easily done by putting them in the proper se-

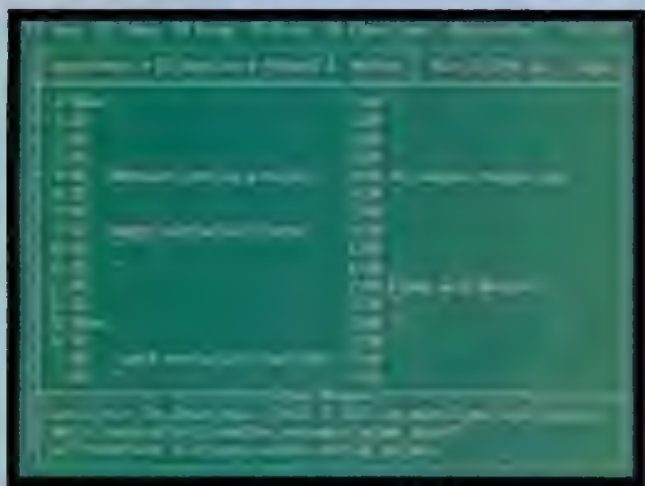


Figure 2: SCHEDULE's daily appointment book lets you save entries and changes with a single keystroke. You can also archive old appointments so you can keep a permanent record without having to reload them daily.

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Utilities

quence in your AUTOEXEC.BAT file. Second, when you run or install SCHEDULE your current directory must be the directory in which the program is stored. This is so SCHEDULE will know where to store its appointment data files. Suggestions on how best to do this are discussed in the section on batch files, below.

OPERATING SCHEDULE

I've tried to make getting around in SCHEDULE as intuitive as possible. The arrow keys work as you'd expect. The PgUp and PgDn keys take you to the previous or following month in the calendar screen and the previous or following day in the appointment screen. Ctrl-PgUp or -PgDn produces bigger jumps—a year at a time in the calendar screen and a month at a time in the appointment screen.

The Tab key moves you around the three sections (left, right, and notepad) of the appointment screen; Shift-Tab goes in the opposite direction. A summary of SCHEDULE's commands is given in the DOS manual page. Here is a more detailed explanation of the active function keys in the menu bar at the top of the screen.

■ **F2 (Save):** Pressing F2 at any time saves the current contents of the appointment screen to a disk file called SCHEDULE.DAT. SCHEDULE can store months of appointments on-disk, but it has room in RAM to hold only one day's worth of appointments at a time. Therefore, after entering or changing a day's appointments, save them to disk.

If you change the appointment screen and forget to save it, SCHEDULE will remind you and ask if you wish to save to disk. Answer Y if you wish to do so. If you do not save your appointments to disk, they will remain in memory only as long as you do not select another month or day.

■ **F3 (Today):** The F3 key quickly returns you to today's date after you've roamed elsewhere. Today's date is highlighted in yellow on color displays and in white on monochrome displays.

■ **F4 (Purge):** Each time you use the PgUp/PgDn keys to examine a new month in the calendar screen or a new day in the appointment screen, SCHEDULE has to go through the whole SCHEDULE.DAT disk file to find the appropriate data. After saving a few months of appointments, you'll probably find that SCHEDULE's

CUSTOMIZING SCHEDULE

by Michael J. Mefford

The following instructions will enable you to customize the colors used by SCHEDULE and to change the tone of its chime. Start by making a backup copy of SCHEDULE.COM and then enter

```
DEBUG SCHEDULE.COM
```

You are now ready to modify SCHEDULE.COM. If at any time you make a mistake, you can abort the editing process by entering Q. After entering any desired modifications, the last two commands you enter are

```
W
Q
```

for Write to disk and Quit DEBUG.

COLOR SCHEME

Enter the following DEBUG E(nte)r instructions, replacing the xx with a new hexadecimal color value. The default color values and descriptions that SCHEDULE uses are shown as comments, typed in to the right of the semi-colons.

```
E 578 xx ; 17 Lt. gray on blue
E 579 xx ; 71 Blue on lt. gray
E 57A xx ; 1E Yellow on blue
E 57B xx ; 3B Bright cyan on cyan
E 57C xx ; 1B Bright cyan on blue
E 57D xx ; 7E Yellow on lt. gray
```

Alternative colors may be selected from the following list. The background color number is entered for the first x and the foreground color for the

second x. Do not use a light color for the foreground, or the display will blink.

Dark colors	Light colors
0 Black	8 Dark gray
1 Blue	9 Lt. blue
2 Green	A Lt. green
3 Cyan	B Lt. cyan
4 Red	C Orange
5 Magenta	D Violet
6 Brown	E Yellow
7 Lt. gray	F White

For example, to change the yellow on blue (1E) to red on blue (14), you would enter

```
E 57A 14
```

CHIME TONE

The value used to calculate the tone of the chime is a hexadecimal number that can range from a low of 0025 to a high of 1150. The default value is 0416. You will find numbers close to the default more pleasing. In order to change the tone, enter

```
E 584 yy xx
```

where xyy is the new tone divisor. For example, to change the tone from the 416-Hz C note to an A (a divisor of 370), you would enter

```
E 584 70 03
```

Note that the numbers must be entered exactly as shown above. The string 70 03 (yy xx) represents 0370 (xyy).

response as you page through appointments is becoming sluggish. That's the time to purge or archive old appointments from SCHEDULE.DAT.

Press F4 and SCHEDULE brings up a purge menu with a purge date the same as the current cursor location on the calendar. This will be the current appointment date if you press F4 while in the appointment screen. You can select another purge date by using the Pg keys. Usually, however, you'll choose today's date by pressing F3. You then press F7 to purge all old appointments up to (but not including) the dis-

played purge date. You can also purge specific dates by pressing F8 (Purge Date Only). This is handy if plans change and you need to delete all previously saved appointments on a particular date.

Once the type of purge is selected (F7 for all old appointments, F8 for specific days), SCHEDULE will ask whether you want to archive the material being removed from SCHEDULE.DAT. Pressing N will simply discard the purged data. Pressing Y lets you archive all purged appointments by appending them to a file named SCHEDULE.ASC. This lets you

Utilities

keep a history of all old appointments, perhaps for tax or accounting purposes. SCHEDULE.ASC is an ASCII text file that is readable and printable by any word processor. You can cancel the purge function at any time by pressing Esc.

If the disk to which you are saving your appointment data becomes full (a concern if you're working with a floppy disk-based laptop), you'll find that you cannot save an appointment with F2. SCHEDULE will inform you of the situation (or of any other disk access failure) with an "Update failed" message. You can purge old appointments in SCHEDULE.DAT to make room for your new ones. Note, however, that if your disk is full, you won't be able to archive while purging. The solution is to exit SCHEDULE and make room on your disk before archiving. The easiest way to do this is to move the old SCHEDULE.ASC onto a floppy disk.

■ **F5 (Print):** When you go on a trip, you will want a hard copy of your schedule. Pressing F5 from the calendar screen will print the monthly calendar, and pressing it from the appointment screen will print the daily appointments. After pressing F5, you will be asked to select either printer 1 or printer 2. If you have only one printer, press 1; pressing 2 in that case will give you a warning beep.

If the paper is set at the top of the form when you start, you can neatly fit two schedules on one page. If you print more than two, they will continue to be correctly positioned on subsequent pages.

■ **F6 (Notepad/Clear Line):** There wasn't enough room to show F6 in the calendar menu bar. Pressing F6 (or the letter *N*) from the calendar screen will quickly take you to the highlighted day's notepad section in the appointment screen.

If pressed while you are viewing the appointment screen, F6 has a different function: it clears the line the cursor is currently on. Pressing Shift-F6 clears an entire section (left, right, or notepad). Ctrl-F6 clears all three sections.

BATCH FILES

Since SCHEDULE won't run unless it's in the current directory, the best way to run or install it is from a batch file that changes directories automatically. You can keep SCHEDULE in any directory you like, but I suggest you make a separate directory,

\SCHED, for SCHEDULE.COM and the two files it creates: SCHEDULE.DAT (current appointment data) and SCHEDULE.ASC (archived purged data). Assuming you follow this suggestion and are on the C: drive, you then can create the following batch file, called S.BAT:

```
C:
CD \SCHED
SCHEDULE %1 %2 %3 %4
CD \
```

The short name of S.BAT means you have to enter only the letter S, followed by any desired command-line switches. The % parameters will pass the latter on to the program. Of course, modify the drive and path arguments if you choose to store SCHEDULE somewhere other than in C:\SCHED.

Once you're familiar with the program's syntax, you may wish to add the redirection command > NUL to the end of the % parameters, as follows:

```
SCHEDULE %1 %2 %3 %4 > NUL
```

If you do this, your screen won't get cluttered with SCHEDULE's copyright and syntax sign-on message.

Likewise, if you have a specific configuration that you always want to use—a hotkey of Ctrl-S instead of the default Alt-C—and you want the graphic characters to be used in printing, you can state that right in the batch file to avoid typing them in.

```
C:
CD \SCHED
SCHEDULE /H Ctrl S /G
CD \
```

If memory is tight for some applications but not for others, or if you find hotkey conflicts with some applications, you might consider using SCHEDULE uninstall/install or hotkey commands in your application's batch file. For example, if *Lotus 1-2-3* needs all available elbow room and you have installed SCHEDULE, create the following batch file to remove it from memory temporarily:

```
SCHEDULE /U
CD \123
123
CD \SCHED
SCHEDULE /I
```

Changing the hotkey after SCHED-

ULE is installed is just as easy. If you have a *WordPerfect* macro hooked to Alt-C, for example, use the following commands to change SCHEDULE's hotkey in your WP.BAT.

```
SCHEDULE /H Ctrl S
CD \WP
WP
```

Note that you do not have to be in SCHEDULE's directory in order to change its configuration with command-line options after SCHEDULE is installed. The SCHED subdirectory has to be on the DOS PATH. Of course, if you want to install SCHEDULE when you boot, you should put the appropriate batch commands in your AUTOEXEC.BAT file.

FOR THE TECHNICALLY CURIOUS

SCHEDULE produces a nice side effect on computers that are left running 24 hours a day. If you leave yours running, you may have found that its clock sometimes loses a day or two, especially over a weekend. No, your computer didn't go on a lost weekend. It's simply that the PC actually has two different clocks. One is kept by the BIOS, which keeps time in hours and 1/18th-second fractions. The other is kept by DOS, which converts the BIOS's fractions of a second into minutes and hours and also keeps track of days and years.

The BIOS clock gets updated continually, 18 times a second, via interrupt 8. The DOS clock, however, gets updated only when it's asked what time it is, either from the DOS prompt (using the TIME/DATE command) or from within a program (via a DOS time-function call). It's the DOS clock that gets out of sync, and here's the reason.

When the BIOS hour counter passes 24, it is reset to 0. At the same time, a rollover byte is set to 1 to mark a new day. When yet another new day comes around and the hour counter reaches 24 again, the rollover byte is not set to 2, as you would expect; it's set to 1 again. In other words, it acts only as a flag to indicate that the hour counter has rolled over.

DOS gets its time from the BIOS clock. When DOS is asked what time it is, either from the DOS prompt with the TIME command or from a program via a DOS time-function call, DOS looks at the rollover byte. If its value is 1, DOS adds one day to the date and resets the rollover byte to 0 so the next new day can be detected. If, however, two or more days go by before DOS

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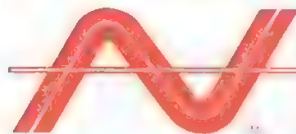
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To download SCHEDULE.COM and its assembly or BASIC listings, log on to PC MagNet. Enter GO UTILITIES or choose PC MAGAZINE UTILITIES from the top menu, then DIRECT UTILITY DOWNLOAD from the next menu. Enter the filename, then select the file you want to download from those presented. Answer yes (Y) to DO YOU WISH TO DOWNLOAD? Press Enter to see the transfer protocols. Choose a protocol and download the file.

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Michael J. Mefford

SCHEDULE Command

March 27, 1990 (Utilities)

Purpose:

An appointment scheduler that provides both a monthly overview and a detailed daily screen with notepad and optional reminder chime; includes editing, printing, and archiving facilities and can be used as either a standalone or a memory-resident utility (15K of RAM required).

Format:

SCHEDULE [/I] [/U] [/Hn] [/Pn...n] [/G] [/A] [/C] [/M] [/B]

Remarks:

When installed as a memory-resident program by using the optional /I switch, SCHEDULE automatically reminds you of appointments by chiming and popping up its appointment screen. The default hotkey is Alt-C. This can be changed with the /H switch to any alphanumeric Ctrl- or Alt-key combination (n), either at or after installation. To make Ctrl-S the hotkey, enter SCHEDULE /H Ctrl S. The /P parameter allows sending up to ten decimal printer setup codes (n...n). Include the /G switch for printers that support the IBM line-drawing characters.

The reminder chime can be disabled by including the /C switch, and automatic screen pop-up can be avoided by using the /A option. The /M parameter prevents the default midnight pop-up so that overnight programs can be run. If screen contrast is a problem (for example, with laptops), use the /B (black-and-white) option or change the default colors, as explained in the accompanying article. SCHEDULE can be uninstalled with the /U option, subject to usual limitations.

SCHEDULE.COM and the two files it creates (SCHEDULE.DAT and SCHEDULE.ASC) must be stored in the current directory when the program is run as a standalone or installed as a memory-resident utility. Batch files described in the accompanying article will simplify this requirement. As a text-based program, SCHEDULE will not come up over a graphics screen (for example, *Microsoft Windows*); it must be installed before *SideKick* (if used).

SCHEDULE.DAT contains all appointment records saved by pressing F2 (see the command summary which follows). It can be purged or archived in whole or part by pressing F4. A suitable purge date can be selected by F3 (today) or with the PgUp and PgDn keys (move by days) or with Ctrl-PgUp or -PgDn (move by months). F8 selects an individ-

CONTINUES

Utilities

SCHEDULE BY MODEM

Like all good software, the programs presented in *PC Magazine* are upgraded and improved. However, the only way you can obtain the modified versions of these programs is to download them from PC MagNet. Here is a partial list of the programs that have been upgraded to fix minor bugs and system incompatibilities:

ANSI.COM, Version 1.3
 BEN51.EXE (benchmark tests, Version 5.1)
 CARDFILE.COM, Version 1.1
 CHKFRAG.EXE, Version 1.2 (now works with volumes greater than 32MB)
 DIRMATCH.COM, Version 1.1
 EMS40.SYS, Version 1.1 (fixes a problem with Lotus 1-2-3)
 LITES.COM, Version 1.1
 LOG.COM, Version 1.1
 PCMANAGE.EXE, Version 1.1
 RN.COM, Version 2.0 (now works under DOS 4.x)
 SLICE.COM, Version 1.3
 SNIPPER.COM, Version 1.2
 ZCOPY.COM, Version 1.2

For a complete list of all the programs available from the PC MagNet Utilities Database, download UDCAT.ARC.

A downloadable index to *PC Magazine's* product reviews is also available. PCM.EXE is a self-extracting file that contains the Computer Library's *PC Magazine Reviews Index* for January 1988 to June 1989. This easy-to-use database is a subset of the Computer Library Periodicals Database, which is available on CD-ROM and from PC MagNet. It requires the search files in PCSRCH.EXE.

PCSRCH.EXE is a self-extracting archive containing the software used to retrieve citations from the *PC Magazine Reviews Index*. Please read the information file PCM.INF before you download any of these files.

ual day for purging. Menu prompts are provided for determining whether the selected records are deleted or automatically appended to SCHEDULE. ASC to provide a permanent record usable by any ASCII editor.

The monthly ("calendar") and daily ("appointment") displays cover the period from 6:30 A.M. to 9:30 P.M. in hour and half-hour increments, respectively. Within each screen the following commands can be executed:

Keystroke	Calendar Screen	Appointment Screen
PgUp/PgDn	Next month	Next day
Ctrl-PgUp/-PgDn	Next year	Next month
Arrow keys	Select day	Navigate screen
Home(1)	Beg. of column	Beg. section column
Home(2)	Beg. of calendar	Top of section
End(1)	End of column	End section column
End(2)	End of calendar	End of section
Ctrl-Home	Beg. of calendar	Beg. of section
Ctrl-End	End of calendar	End of section
Ctrl←	Beg. of column	Beg. section column
Ctrl→	End of column	End section column
Enter	Select app't.	Enter
Esc	Exit SCHEDULE	Return to calendar
F2	Save appt's	Save appt's
F3	Today	Today
F4	Purge appt's	Purge appt's
F5	Print calendar	Print appt's
F6	Go to notepad	
Shift-F6	Undefined	Clear section
Ctrl-F6	Undefined	Clear all three sections
Tab	Undefined	Go to next section
Shift-Tab	Undefined	Go to prev. section
Del	Undefined	Del. char. at cursor

ENDS

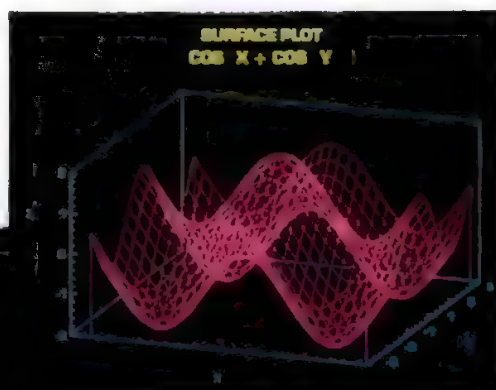
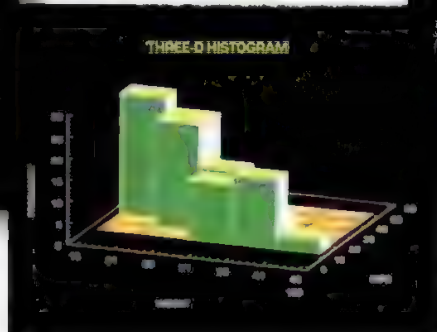
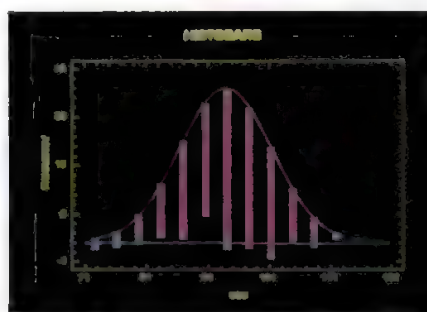
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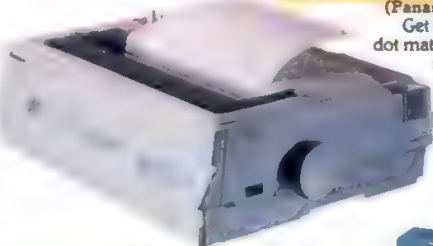
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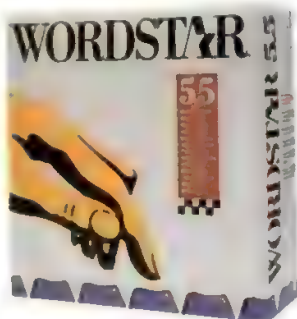


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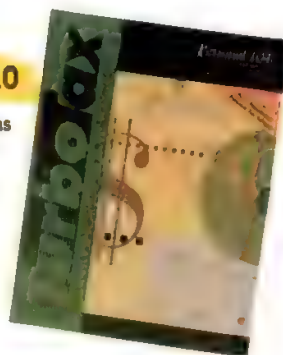
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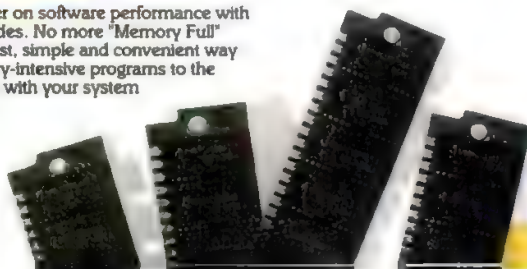
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Utilities

is asked what time it is, DOS sees only the 1 and adds only 1 to the date. DOS has no idea how many times the BIOS 24-hour counter has rolled over, so the date is incorrectly updated.

SCHEDULE hooks into the BIOS's interrupt 8 so it can keep a tight watch on the time and set off the chime when an appointment comes up. When midnight (actually 12:01 A.M.) arrives, SCHEDULE knows it must get the next day's appointments from the disk. At this time SCHEDULE also pops up so the appointment screen will be awaiting you when you arrive at work. In the process of popping up, however, SCHEDULE must query DOS for the date so it can update today's date in the calendar screen. DOS, in turn, looks at the BIOS rollover byte and finds the 1 indicating a new day and updates its date. The result is that two days can never go by without DOS's clock getting updated automatically.

SCHEDULE has a calendar algorithm embedded in its code, so it really *could* figure out the new date on its own, but asking DOS is just as easy and has the additional benefit of keeping DOS's clock accurate.

So why doesn't the date go awry when you turn off the machine every night and the BIOS counter stops? Most systems have yet a third, battery-operated clock, either on the motherboard or on an add-on card. (Otherwise, you have to type in the date each day when you boot.) As part of the boot process, the BIOS and DOS counters get off on the right foot by reading the battery-operated clock.

The source code for SCHEDULE is loaded with all sorts of goodies (including all the ingredients for a DOS entrant TSR), but space precludes discussing them here. If you'd like to get into the programming details in greater depth, just download the source code from PC MagNet and look for me there, too.

And remember that SCHEDULE can do more than keep your business life in order. You also can count on it to remind you of important dates like birthdays and holidays. If you're married, the first entry you'd better make is your anniversary. And block out enough time to get the present!

Michael J. Mefford is a contributing editor of PC Magazine.

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CIRCLE 144 ON READER SERVICE CARD

by
Charles Petzold

Environments

Hardware devices require software support. In order to make use of a piece of hardware, an application program must either know how to control the hardware directly, or it must be able to communicate with the hardware through some other software in the system.

For example, a program running in the DOS environment often needs to access files on a disk. To do this, the program either uses the interrupt 21h services provided by DOS, or it uses high-level language functions that the compiler translates into interrupt 21h calls. In response to these interrupt 21h calls, DOS makes calls to a device driver to access the required sectors of the disk. The device driver either controls the hardware directly or makes use of the BIOS interrupt 13h interface to the disk controller.

For the most part, fortunately, application programs themselves do not access the disk hardware directly. If they did, and you just happened to buy a new hard disk and controller, you would discover that all your application programs required updates in order to use your new piece of hardware! As it is, the most you'll need is a new software interface (such as a device driver). With that, all your applications can use files on your new hard disk.

DEVICE INDEPENDENCE

This is what is known as a device-independent interface. Application programs use a consistent software interface that hides the hardware-specific variations from them.

In the OS/2 Presentation Manager, this concept of device independence has been extended to graphical output devices, such as video displays and printers. As I've noted on previous occasions in this column, the Presentation Manager's Graphics Programming Interface (GPI) is a device-independent graphics software interface. Simply by calling GPI functions, Presentation Manager programs can display graphics on any video display or printer for which an OS/2 presentation driver has been installed.

Printing Under the OS/2 Presentation Manager, Part 3

■ A calendar-printing program illustrates both the promise and the pitfalls of OS/2's device-independent interface.

This provides an enormous benefit to programmers, users, and even hardware manufacturers. The programmer obviously benefits by avoiding the problem of supporting a huge and constantly growing number of individual graphics output devices. The user benefits when upgrading to a new video display or printer, for by installing a single PM driver for the new output device, all existing PM programs will be able to use it. This is true even if the device was invented after the programs were written!

Hardware manufacturers of video displays and printers also benefit. Although writing and debugging a presentation driver may be an initial hassle, it guarantees that the device is usable by existing PM applications. Hardware manufacturers can thus use their engineering creativity to produce new and better graphics devices without worrying about maintaining compatibility with older devices.

In our November 14, 1989, issue, I showed you a Presentation Manager program called BEZIER, which displays a Bézier spline curve and lets you manipulate it. The same program runs on CGA, EGA, VGA, and 8514/A displays without requiring any special code for any of these

video adapters. If you install a different video board and a Presentation Manager driver, the program will also run on that board. I don't even have to test the program to tell you that this is so.

Of course, the reality of device independence won't match the promise unless the drivers are free of bugs. As we'll see shortly, the PostScript driver shipped with the initial release of IBM OS/2 1.2 doesn't quite make it.

PRINTING A CALENDAR

In this issue and the next one, I present a program called PRINTCAL. It prints a wall calendar, one month to a page. The graphics are fairly simple—just a number of lines and a GPI vector font. Figure 1 shows pages from this program printed on three different output devices I own: a NEC SilentWriter LC-890 PostScript Page Printer, an IBM Model 5152 dot matrix Graphics Printer, and a Hewlett-Packard Model 7440A ColorPro pen plotter. Since IBM OS/2 1.2 shipped with presentation drivers for all three of these printers, it was a fairly simple matter to use the Print Manager to switch the default printer to each of these devices and then run the PRINTCAL program.

The three pages can't be expected to look identical, of course. The three devices—a 300-dot-per-inch page printer, a dot matrix printer, and a pen plotter—have different resolutions and render images on the page in very different ways. Moreover, the three devices have different margins (the area of the page on which the printer cannot print).

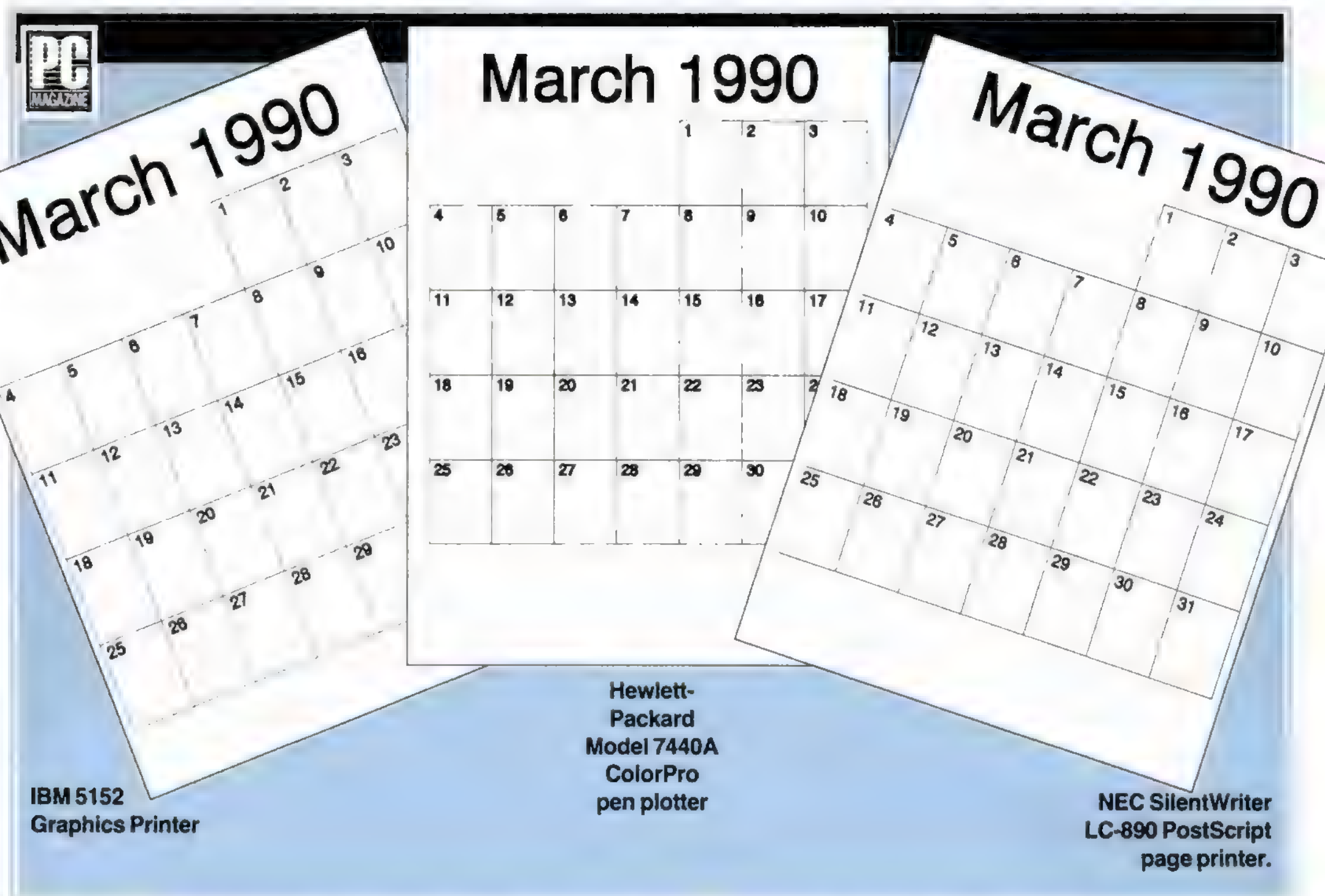


Figure 1: These calendar pages were produced under the OS/2 Presentation Manager by the IBM Graphics Printer, the Hewlett-Packard ColorPro Plotter, and the NEC LC-890 PostScript Page Printer. Although margins will differ from device to device, the missing line defining the left border of the calendar to the extreme right is the result of a bug in the PostScript device driver.

The presentation driver is responsible for positioning the graphics origin at the lower-left corner of the printable area of the page and for returning information indicating the width and height of the printable area to the program. At least, that's what's supposed to happen. You'll notice that the vertical line on the left side of the calendar is missing from the PostScript (NEC LC-890) example.

The missing line is obviously a bug in the driver. While writing an early version of PRINTCAL, I used a PostScript driver distributed in the last installment of Microsoft's old \$3,000 OS/2 Software Developer's Kit. That driver was itself very buggy, but at least it did know about the page margins of the NEC LC-890. We can only hope that the current PostScript driver will soon be fixed.

As I write this column, I have not yet

seen the presentation driver for the Hewlett-Packard LaserJet. Many of you won't be able to make use of the PRINTCAL program until the HP driver is available. However, I'm not at all worried but that my program will run on a LaserJet when the driver (assuming that it's bug-free) becomes available. That's the guarantee you get with a device-independent graphics interface.

USING PRINTCAL

PRINTCAL will run in the Presentation Manager session under either OS/2 1.1 or 1.2. You're likely to need OS/2 1.2, however, because that's the first version that comes with a strong collection of printer drivers. When you first run PRINTCAL, it displays the calendar for the current month in its client window, as shown in Figure 2. The program uses the GPI Helvetica vec-

tor font for both the month and year title at the top and numbers for the day.

The GPI fonts are installed automatically during installation of OS/2 1.2. You have to install them yourself from the Control Panel if you're using OS/2 1.1. If the Helvetica vector font is not installed, the program will use a Courier vector font instead; the Courier vector font is always available.

The use of a GPI vector font for the calendar text contributes greatly to the uniform appearance of the three pages shown in Figure 1. As I discussed in two Environments columns last October, the GPI vector fonts are fully scalable and can be used on any graphics output device that GPI supports. However, using the GPI vector fonts does slow down the screen display, and the numbers are not quite legible at small window sizes.



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Environments



Figure 2: In addition to printing the calendar, PRINTCAL displays the current month in its client window. The GPI Helvetica vector font is used for the letters and numbers.

The calendar in the client window is just a static image, and you can't do anything with it. Indeed, the window image is not necessary for the functioning of the program. Since the program requires a routine to draw the calendar on the printer page, however, it was fairly easy to add the visual display. This illustrates another advantage of device-independent graphics: you can use the same functions for displaying graphics on both the screen and the printer.

The PRINTCAL menu has only one item: Calendar. This item invokes a sub-menu with two options: Print Calendar and About PrintCal. The About PrintCal option simply displays the conventional dialog box with a copyright notice. The Print Calendar option displays the dialog box shown in Figure 3.

In this box you can type in a new year (from 1900 to 2099) and select a beginning and ending month. When you then press the Preview button you'll see the first month of this range in the client window. If you press the Print button, the program will begin the job of printing the range of months. And that brings us to an important point.

THE PRINTING THREAD

PRINTCAL uses a second thread of execution to print. In any Presentation Manager program it's a good idea to create additional threads for handling lengthy processing jobs.

PM programs begin execution with only one thread. This thread generally cre-

ates a message queue to receive messages posted to all the windows created in that thread. If the program starts a lengthy processing job, the thread can no longer receive messages until the job has been completed. The program usually displays the hourglass icon during this time to indicate that the user must wait. Understandably, users hate that hourglass icon with a passion.

It's obvious that having to handle a lengthy processing job—a multipage graphics printout, for example—will prevent a Presentation Manager program from interacting with the user. Unfortunately, however, that same job also prevents the user from switching to another PM program. When you switch to another program in the PM session, the program you are leaving must be notified through messages. These messages are blocked if the thread with the message queue is busy doing something else.

This means that any Presentation Manager program that does lengthy processing in its main message queue thread effectively halts all interaction between the user and all programs running in the Presentation Manager session.

This is the reason for recommending that a PM program create additional threads when lengthy processing jobs are involved. The additional threads do not create message queues and hence can run concurrently with the threads that process messages.

Still, you might think, isn't the purpose of the PM print spooler to save application printer output to a file? This frees up the program while the printer output is later sent to the printer. So why should printing

One advantage of PM's device-independent graphics: you can use the same GPI functions for displaying output on both the screen and the printer.

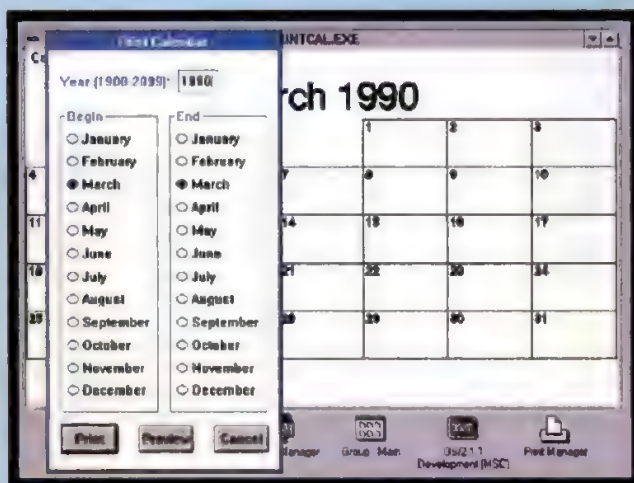


Figure 3: The PRINTCAL dialog box permits you to specify a range of months within a single numbered year. An academic calendar, spanning September through June, requires running the program twice.

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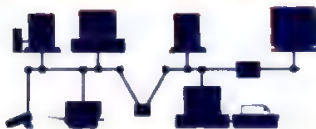
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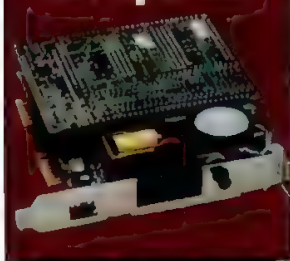
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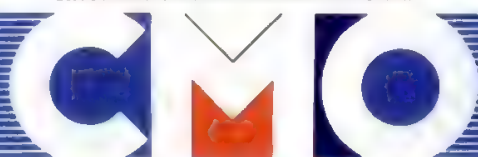
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from a Presentation Manager program require a separate thread?

The answer is that printing is really a two-stage process, and the print spooler only takes care of the second stage. This two-stage process is easiest to understand by considering a dot matrix printer.

When a PM program begins printing graphics to a dot matrix printer, the printer driver must create a large bitmap—the size of the printable area of the page—in memory. Any GPI functions that the program calls must be translated by the driver into 0 bits (white paper background) or 1 bits (black image) in this bitmap. Only when the program completes the page can the bitmap be translated into graphics control sequences that are saved to a file for spool-

ing. This is the first stage. The second stage occurs when the spooler sends the output to the printer.

Although the second stage is generally slower than the first (especially for slow devices like dot matrix printers and pen plotters), the first stage itself can still require a considerable amount of time—perhaps a minute or so for some complex pages. In a multitasking windowing environment, that's a very long time to make the user wait. By putting the first stage of printing into a separate thread of execution, however, a Presentation Manager program can continue to interact with the user even while the printer output is being prepared.

When you push the Print button in the dialog box shown in Figure 3, therefore, PRINTCAL allocates some memory for



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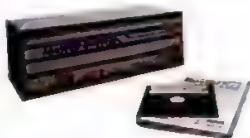
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PRINTCAL uses a second thread to send output to the printer so that the Presentation Manager can continue to interact with the user while the output is being prepared.

the second thread, creates the thread, and displays a message box with the message "Print job successfully started." (If the memory allocation or thread creation fails, message boxes also inform you of this.)

You'll see this message box almost immediately, and you'll start to see some disk output as the second thread prepares the printer output. While this is happening, you can print another range of months (perhaps on another printer), or you can switch to another program.

After the second thread has finished preparing the printer output, you'll see another message box saying either "Print job sent to spooler" or "Error encountered during printing." (The latter message probably indicates that the printer was not configured correctly from the Print Manager). If you get the first message, the print

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Environments

job will show up in the Print Manager window, and the Print Manager will send the output to the printer.

The PRINTCAL dialog box allows you to select only a range of months that falls within one year. If you want to print a range of months that stretches across two or more years (for example, July 1990 through June 1991), you'll have to select separate ranges in each year. But you can do this very quickly and have several printing threads running concurrently. You needn't wait for one print job to finish before starting the next.

THE PRINTCAL FILES

A total of six files are required to create PRINTCAL.EXE. One of these, PRINTDC.C, was published in last issue's Environments column. This file contains a routine, called OpenDefaultPrinterDC, that opens a device context for the default printer. Four more needed files are shown in Figures 4 through 7, and the sixth file, PRINTCAL.C, will be presented and discussed in the next issue. As usual, of course, you can download all the source code (and even PRINTCAL.EXE itself) from PC MagNet.

With these six files in hand, and with the Microsoft C 5.1 compiler and the Microsoft OS/2 1.1 Programmer's Toolkit (or Presentation Manager Softset) installed, you can create PRINTCAL.EXE by executing

MAKE PRINTCAL

If you've been doing some Presentation Manager programming, the files shown in Figures 4 through 7 should look pretty familiar. The PRINTCAL.RC resource script file contains templates for the program's menu and dialog box templates, and PRINTCAL.H contains definitions of the constants used in PRINTCAL.RC.

What may look a little unusual are some of the compiler switches and libraries used in the PRINTCAL make file (Figure 4). These result from the need to use multiple threads in the program.

THE MULTITHREAD LIBRARY

The C programming language was not designed for multithread programming. This is hardly surprising because Unix—the operating system for which C was originally

designed—is not a multithread operating system. Multithread programming can be a little tricky under C. For example, all automatic variables are unique to each thread, while all static variables are shared among threads. It's possible for one thread to clobber static variables that are being used by another thread.

A program usually protects against this

Although C was not
made for multithread
programming,
Microsoft C 5.1
contains a library that
allows a program to
have up to 32 threads.

possibility by using semaphores. However, what can a program do about C runtime library functions that use static variables? In general these functions are not reentrant.

In practice, the answer is disarmingly simple: you use the special multithread library included in Microsoft C 5.1. You may not know about this library, however, for it's not documented in the manual. The only information provided about it is contained in a text file named MTDYNA

.DOC, which is stored in the documentation subdirectory during installation of the compiler.

In order to make use of the multithread library, you must use the C header files stored in the MT (multithread) subdirectory of the normal INCLUDE directory. For example, in the PRINTDC.C file that was shown in the last issue, I needed the STRING.H header file. Rather than including it like this:

```
#include <string.h>
```

I included it like this:

```
#include <mt\string.h>
```

The PRINTCAL make file listed in Figure 4 shows the compiler and LINK switches also required to use the multithread library. The compiler requires the switch

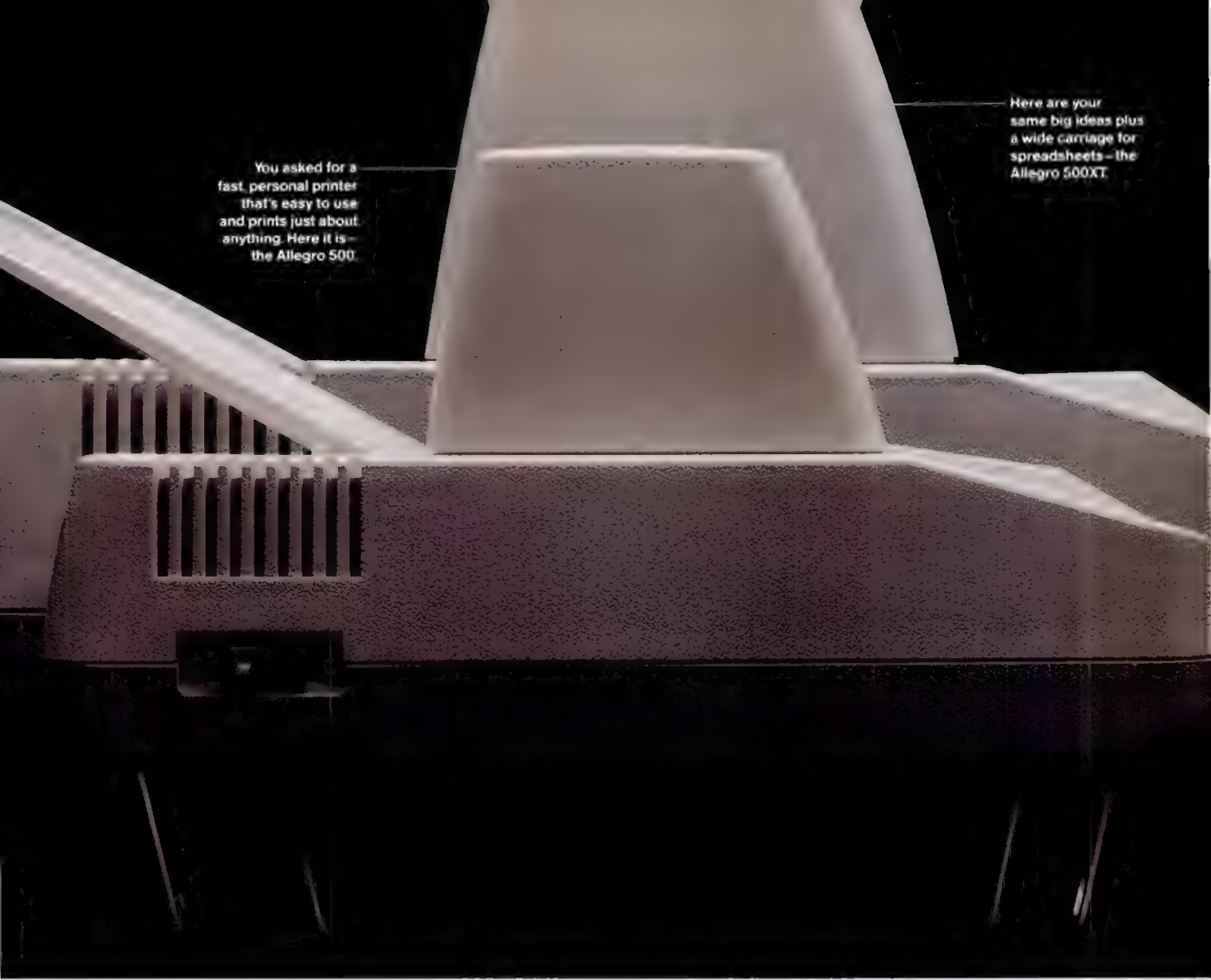
```
-Alfw
```

This is the switch to compile for large model (32-bit segmented addresses used for both code and data pointers) on the assumption that DS (the data segment) is not equal to SS (the stack segment). This is required because the stack memory for the secondary threads could be allocated from outside the program's data segment.

The libraries that are required for linking a multithread OS/2 Presentation Manager program are OS2.LIB, the import library identifying dynamic link library entry points for the OS/2 functions; and LLIBCMT, the large-model multithread C

PRINTCAL	COMPLETE LISTING
<pre>##### # PRINTCAL make file ##### printcal.obj : printcal.c cl -c -Alfw -G2sw -W3 printcal.c printdc.obj : printdc.c cl -c -Alfw -G2sw -W3 printdc.c printcal.res : printcal.rc rc -r printcal printcal.exe : printcal.obj printdc.obj printcal.def link printcal printdc, /align:16, NUL, /nod os2 llibcmt, printcal rc printcal.res printcal.exe : printcal.res rc printcal.res</pre>	

Figure 4: The PRINTCAL make file automates the creation of PRINTCAL.EXE. Some of the unusual compiler switches and libraries are required for a multithreading program.



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Environments

PRINTCAL.RC
COMPLETE LISTING

AVAILABLE ON


```

/*-----
PRINTCAL.RC resource script
-----*/

#include <os2.h>
#include "printcal.h"

MENU_ID_RESOURCE
{
    SUBMENU "--Calendar",                -1
    {
        MENUITEM "--Print Calendar...",  IDM_PRINT
        MENUITEM SEPARATOR
        MENUITEM "A'bout PrintCal...",   IDM_ABOUT
    }
}

DLGTEMPLATE IDD_PRINT
{
    DIALOG "Print Calendar", 0, 16, 16, 160, 220,, FCF_DLGBORDER | FCF_TITLEBAR
    {
        LTEXT "Year (1900-2099):" -1, 8, 200, 80, 8,
        EDITTEXT "--" IDD_YEAR, 92, 200, 24, 8, ES_MARGIN

        GROUPBOX "Begin" -1, 8, 30, 60, 160
        AUTORADIOBUTTON "January" IDD_MONTHBEG + 0, 12, 160, 60, 12, WS_GROUP
        AUTORADIOBUTTON "February" IDD_MONTHBEG + 1, 12, 156, 60, 12
        AUTORADIOBUTTON "March" IDD_MONTHBEG + 2, 12, 144, 60, 12
        AUTORADIOBUTTON "April" IDD_MONTHBEG + 3, 12, 132, 60, 12
        AUTORADIOBUTTON "May" IDD_MONTHBEG + 4, 12, 120, 60, 12
        AUTORADIOBUTTON "June" IDD_MONTHBEG + 5, 12, 108, 60, 12
        AUTORADIOBUTTON "July" IDD_MONTHBEG + 6, 12, 96, 60, 12
        AUTORADIOBUTTON "August" IDD_MONTHBEG + 7, 12, 84, 60, 12
        AUTORADIOBUTTON "September" IDD_MONTHBEG + 8, 12, 72, 60, 12
        AUTORADIOBUTTON "October" IDD_MONTHBEG + 9, 12, 60, 60, 12
        AUTORADIOBUTTON "November" IDD_MONTHBEG + 10, 12, 48, 60, 12
        AUTORADIOBUTTON "December" IDD_MONTHBEG + 11, 12, 36, 60, 12

        GROUPBOX "End" -1, 84, 30, 60, 160
        AUTORADIOBUTTON "January" IDD_MONTHEND + 0, 88, 160, 60, 12, WS_GROUP
        AUTORADIOBUTTON "February" IDD_MONTHEND + 1, 88, 156, 60, 12
        AUTORADIOBUTTON "March" IDD_MONTHEND + 2, 88, 144, 60, 12
        AUTORADIOBUTTON "April" IDD_MONTHEND + 3, 88, 132, 60, 12
        AUTORADIOBUTTON "May" IDD_MONTHEND + 4, 88, 120, 60, 12
        AUTORADIOBUTTON "June" IDD_MONTHEND + 5, 88, 108, 60, 12
        AUTORADIOBUTTON "July" IDD_MONTHEND + 6, 88, 96, 60, 12
        AUTORADIOBUTTON "August" IDD_MONTHEND + 7, 88, 84, 60, 12
        AUTORADIOBUTTON "September" IDD_MONTHEND + 8, 88, 72, 60, 12
        AUTORADIOBUTTON "October" IDD_MONTHEND + 9, 88, 60, 60, 12
        AUTORADIOBUTTON "November" IDD_MONTHEND + 10, 88, 48, 60, 12
        AUTORADIOBUTTON "December" IDD_MONTHEND + 11, 88, 36, 60, 12

        DEFPUSHBUTTON "Print" DID_OK, 8, 8, 40, 16, WS_GROUP
        PUSHBUTTON "Preview" IDD_PREVIEW, 61, 8, 40, 16
        PUSHBUTTON "Cancel" DID_CANCEL, 114, 8, 40, 16
    }
}

DLGTEMPLATE IDD_ABOUT
{
    DIALOG "--", 0, 32, 32, 200, 100,, FCF_DLGBORDER
    {
        CTEXT "PrintCal" -1, 10, 76, 100, 8
        CTEXT "PC Magazine, Vol. 9, Nos. 3 through 6" -1, 10, 52, 100, 8
        CTEXT "(c) 1990, Ziff Communications Co." -1, 10, 42, 100, 8
        CTEXT "Programmed by Charles Petzold, 10/89" -1, 10, 32, 100, 8
        DEFPUSHBUTTON "OK" DID_OK, 80, 8, 40, 16, WS_GROUP
    }
}
    
```

Figure 5: The PRINTCAL.RC resource script contains the templates for the PRINTCAL program's various menu and dialog boxes.

runtime library.

As we'll see in the next issue, a program that uses this multithread library must create a new thread using the function `_beginthread` rather than the OS/2 Lfunction `DosCreateThread`. The multithread library allows a program to have up to 32 threads.

In the multithread library, every static variable in a C runtime library function is actually an array of 32 variables. The function obtains the thread ID and uses this to index the array so that the static variable is associated with the particular thread calling the function.

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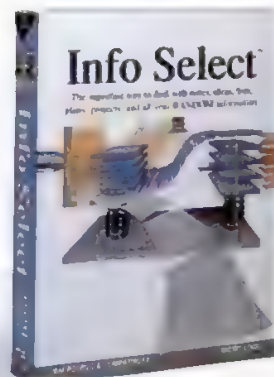
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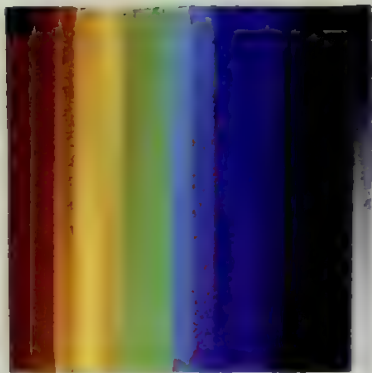
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Power Programming

Getting Acquainted With the Latest Version Of OS/2: 1.2 (Part 1)

Spring has sprung and fall has come, bringing with them another major release, Version 1.2 of Microsoft's OS/2. In what has become a yearly ritual, the battered but unbroken OS/2 independent software developers (ISVs) are staying up late and consuming vast quantities of caffeinated beverages as they try to divine the secrets hidden in the new update. One can't but admire the pluck, faith, and dogged determination of these pioneer ISVs, many of whom have had to rewrite their programs three times before any significant market for their products has materialized.

In this column, I will provide a brief overview of the significant new features of OS/2 1.2—the version that has finally (it was long overdue) gained the imprimatur of a *PC Magazine* Technical Excellence Award in the Operating Environments category. I'll follow up with a more detailed discussion of changes in the OS/2 kernel in the next several issues. My colleague Charles Petzold will, I suspect, be doing much the same thing for the Presentation Manager layer of OS/2 1.2 in his Environments column.

If all goes according to schedule, some of you will already be working with beta versions of OS/2 2.0 for the 80386 by the time this column appears in print. If you are one of those lucky developers, read on anyway: nearly all the topics explored here will be equally applicable to OS/2 2.0.

OS/2 1.2 USER INTERFACE

For experienced OS/2 users, the most immediately striking aspect of Version 1.2 will be the new look of the Presentation Manager shell programs and desktop. The graphical objects used on the desktop have been radically overhauled to make them more subtle, as well as far more attractive. This is particularly true of the ubiquitous buttons and sliders, which are now rendered in a visually harmonious gray tone and have a three-dimensional appearance.

The various utility programs supplied as part of the Presentation Manager shell—the DeskTop Manager, File Man-

■ Improvements in its graphical interface, and in its new and generalized functions, have moved OS/2 into the major leagues.

ager, Control Panel, Print Spooler, and so on—have also been extensively redesigned, and most are considerably easier to use than their previous incarnations.

The functions of the old Task Manager have largely been absorbed by the DeskTop Manager, whose list of active processes pops up automatically under the mouse cursor whenever you exit from an application or click the right mouse button over the desktop background. All of the components of the new PM shell support long filenames and extended file attributes (more about these later). An application's icon can now automatically be displayed alongside its name or the name of its data files, if desired.

Two features of the new DeskTop Manager deserve special mention. First, it is now possible to install real-mode (that is, DOS) applications in the DeskTop Manager's menus and launch them directly with a mouseclick, just as with a protected-mode program. You no longer need to double-click on the DOS box icon and then enter the real-mode application's name manually. This capability is apparently implemented through a small device driver (DOS.SYS) called by the PM shell; the

driver knows how to jam a command line (or perhaps the name of a batch file?) directly into the DOS box's COMMAND.COM.

Second, the DeskTop Manager's menus contain an extremely important new option: ShutDown. Selecting ShutDown signals the file system to flush its cache buffers and bring all disk files and directories to a consistent state before the system is powered down. (It also sends a message to all active PM applications enabling them to pop up a dialog box warning you to save your work if necessary.) Failure to use ShutDown appropriately before turning off your machine can leave your fixed disk in a state such that OS/2 will refuse to boot. "Aha," you may say, "what happens if you impulsively hit Ctrl-Alt-Del?" Fortunately, this problem has been anticipated: the PM shell traps the Ctrl-Alt-Del key combination and gives the file system a chance to write everything out before the reboot.

Perusing the new file manager's various display modes and menus reveals another new feature of OS/2 1.2: support for extended attributes (EAs). Like DOS, earlier versions of OS/2 supported simple file and directory attributes in the form of bit flags that indicated whether a file was hidden, read-only, or whatever. These bit flags were stored in the directory entry for the file and had to be queried or modified through special-purpose function calls; they were not visible to an application as part of a file's contents.

Extended attributes are like the older, simpler attributes in that they are stored

Power Programming

"outside" a file and must be manipulated with special function calls. However, extended attributes are very general: up to 64K of binary or ASCII information can be associated with each file or directory in the form of one or more EAs. Each EA is conceptually somewhat like an environment variable, and although the EAs are not actually stored in this exact format, they can be thought of as taking the form

```
name=ASCIIZ string
```

or

```
name=<binary data>
```

Microsoft intends EAs to be a fundamental building block of its object-oriented file systems and user interfaces. To set the stage for these developments, it has defined certain EAs (such as .ASSOC-TABLE, .TYPE, .KEYPHRASES, .HISTORY, .VERSION, .ICON, and .TYPE) that are recognized by the PM shell and that should be maintained by application programs. Later versions of OS/2 may allow files to be searched for or opened using the "values" of their EAs as well as their filenames.

An in-depth discussion of the other new user-oriented features of OS/2 1.2—such as dual-boot capability, a swappable DOS compatibility box, a process status utility (PSTAT.EXE), and on-line documentation—are probably better left to *PC Magazine's* regular review process. But it is important to point out here that, in terms of usability, friendliness, and aesthetics, the sum of these changes brings the OS/2 Presentation Manager into the same league as the Macintosh's elegant System and Finder for the first time. The era of the graphical user interface on IBM-compatible personal computers has really, truly, and finally arrived.

OS/2 1.2 KERNEL STRUCTURE

The operating-system kernel has also come in for its share of revamping in Version 1.2. Most of the modifications to the kernel relate to support for installable file systems in general and the High Performance File System (HPFS) in particular.

The concept of an installable file system is simple but powerful. From the standpoint of software (as distinguished

from the physical data structures on a disk), the phrase *file system* refers to the module of the operating system that transforms "logical" file requests from an application program (such as open, create, seek, read, or write) into sector-oriented requests that can be serviced by the disk device driver.

In previous versions of OS/2, the FAT file system was an integral part of the kernel and could not be replaced or changed. In OS/2 1.2, file systems can be installed

OS/2 1.2 boasts the powerful High Performance File System, which transforms the "logical" file requests of an application program into sector-oriented requests.

from separate files during system initialization with CONFIG.SYS directives, much like device drivers. The file systems communicate with the kernel and (via the kernel) with device drivers using special kernel entry points called File System Helpers (FSHlps).

Support for installable file systems will make it possible to mount and access multiple incompatible volume types simultaneously on an OS/2 system. It will not be very long before we see installable file systems for CD-ROMs' Macintosh and Unix disks, and even vintage CP/M floppies.

This will vastly simplify life for vendors of networks, WORM drives, and other storage devices with unusual characteristics. These vendors will no longer have to emulate the behavior of a FAT volume on media for which FAT control structures are highly inappropriate. Most important, installable file systems will open the door to rapid file system evolution, because improvements in the file-system will no long-

er be tied irrevocably to the operating system's product life cycle.

The first example of an installable file system is the High Performance File System, which is being delivered with OS/2 1.2. The HPFS was designed by Gordon Letwin, chief architect of OS/2, and it represents a clean and complete break with the FAT file systems used in OS/2 1.0, OS/2 1.1, and all versions (to date) of DOS. The HPFS is capable of supporting volumes as large as 2 terabytes, and it can deliver excellent performance even under unusually stressful conditions (a few huge files or many very small files) that bog down other file systems. It achieves this performance through such advanced strategies as the use of sorted B-tree directories; B+ tree allocation structures; free-space bitmaps; extensive caching of sectors, directories, and paths; and intelligent read-ahead and write-behind (lazy writes).

It's safe to say that the HPFS is one of the most sophisticated chunks of system software that has ever been developed and implemented on microcomputers. It is probably one of the most innovative, as well. Certainly it blows all other file systems used on personal computers or workstations out of the water—including the Fast File System of BSD Unix—and its power compares favorably with that of file systems on the largest minicomputers and mainframes. We'll be delving further into the capabilities and internal structure of the HPFS in forthcoming columns.

OS/2 1.2 KERNEL PROGRAMMING ISSUES

OS/2 1.2 has a number of new or expanded kernel and Presentation Manager APIs, messages, structures, and DosDevIOCtl subfunctions. Detailed documentation for these can be found in Volume 4 of *The Microsoft OS/2 Programmer's Reference Library* (\$19.95; ISBN 1-55615-259-0; Microsoft Corp.), available from your favorite technical bookstore. I've listed the most-significant changes to the kernel API in Figure 1; as you might expect, many of them are related to file-system operations. (The APIs that were actually changed in OS/2 1.1 but not documented by Microsoft until OS/2 1.2 have been omitted from the list. These are DosAllocSeg, DosAllocHuge, DosReallocSeg, DosReallocHuge, DosGetPrty, and DosSetPrty.)

The three new API functions that are most generally useful are DosCopy, DosFileIO, and DosEditName. DosCopy creates a copy of a file, an entire directory, or even a directory subtree. The new file(s)



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may be located anywhere in the directory structure. Any extended attributes associated with the files are also duplicated appropriately.

In essence, `DosCopy` is the API equivalent of the venerable `XCOPY.EXE` utility. `DosFileIO` can perform a seek, lock, read or write, and unlock operation on a file, all in a single, atomic function call. This valuable API, which OS/2 should have had from the beginning, allows threads to share file handles without resorting to explicit serialization mechanisms such as semaphores.

The `DosEditName` function can be used to map pieces of one filename into another filename selectively, allowing you to construct the name of a backup file, initialization file, or other program resource. For example, if you feed the strings `C:\MYDIR\MYFILE.DAT` and `*.BAK` into `DosEditName`, you'll get back the string `C:\MYDIR\MYFILE.BAK`. It's unfortunate that the operating system's designers didn't take this API function a bit further and provide us with a generalized

`DosQFileInfo`, `DosSetFileInfo`, `DosQPathInfo`, and `DosSetPathInfo` allow a program to inspect, change, or delete the extended attributes of a file or directory. `DosEnumAttribute` can be called to get all or part of the attributes associated with a file handle, filename, or directory name. `DosEnumAttribute` is the most appropriate function for browsing or cataloging programs that don't need to modify EA information.

The `DosQFileInfo` and `DosSetFileInfo` functions can be used together to retrieve, modify, and rewrite the extended attributes associated with a particular file. Of course, these two functions also continue to support their original capabilities: returning and setting date, time, and size information of an individual file. `DosQPathInfo` and `DosSetPathInfo` are analogous to `DosQFileInfo` and `DosSetFileInfo`, but are generalized to operate on any arbitrary pathname, which includes directories. Consequently, `DosQPathInfo` and `DosSetPathInfo` should be used in preference to `DosQFileInfo` and `DosSetFileInfo` in all new programs.

The functions `DosOpen2`, `DosFindFirst2`, and `DosMkDir2` are the sorest disappointments of OS/2 1.2, for they reveal that, still, no one person with any feeling for the symmetry and elegance of the kernel API is at the helm of OS/2 development. `DosOpen2`, `DosFindFirst2`, and `DosMkDir2` are exactly analogous to the original `DosOpen`, `DosFindFirst`, and `DosMkDir`, except that they accept one more parameter. This additional parameter is a pointer to a structure that defines or receives extended attributes for the file or directory that is being opened, created, or searched for.

The irony of the situation is that all three of the original functions—`DosOpen`, `DosFindFirst`, and `DosMkDir`—have a "reserved" double-word parameter that was required to be 0 in OS/2 1.0 and 1.1. The definition of the three new functions, `DosOpen2`, `DosFindFirst2`, and `DosMkDir2`, was thus completely unnecessary. The original three functions could have been extended in a very natural way to cope with EAs simply by allowing their reserved parameter to be a pointer in OS/2 1.2. It certainly seems silly to continue "saving" that reserved parameter for some unknown future need, especially since Microsoft and IBM have already made it pretty clear that OS/2 1.2 is the end of the line for 80286 versions of the operating system.

In OS/2 1.2, veteran API functions `DosQFileInfo` and `DosSetFileInfo` can be used together to retrieve, modify, and rewrite the extended attributes associated with a particular file.

file- and path-parsing facility—especially in view of the long, free-form, mixed-case filenames, with embedded blanks and multiple delimiters, that OS/2 1.2 supports.

The functions `DosEnumAttribute`,

PC MAGAZINE OS/2 1.2 API FUNCTIONS			
API Function	New	Major changes	Minor changes
<code>DosCopy</code>	✓		
<code>DosDevIOCtl2</code>	✓		
<code>DosEditName</code>	✓		
<code>DosEnterCritSec</code>			✓
<code>DosEnumAttribute</code>	✓		
<code>DosExitCritSec</code>			✓
<code>DosFileIO</code>	✓		
<code>DosFindFirst2</code>	✓		
<code>DosFindNext</code>		✓	
<code>DosFreeResource</code>	✓		
<code>DosFSAttach</code>	✓		
<code>DosFSCtl</code>	✓		
<code>DosGetResource</code>		✓	
<code>DosGetResource2</code>	✓		
<code>DosMkDir2</code>	✓		
<code>DosMonReg</code>			✓
<code>DosOpen</code>			✓
<code>DosOpen2</code>	✓		
<code>DosQFHandState</code>			✓
<code>DosQFileInfo</code>		✓	
<code>DosQFSAttach</code>	✓		
<code>DosQPathInfo</code>	✓		
<code>DosQProcStatus</code>	✓		
<code>DosSearchPath</code>			✓
<code>DosSetFileInfo</code>		✓	
<code>DosSetMaxFH</code>		✓	
<code>DosSetPathInfo</code>	✓		
<code>DosShutDown</code>	✓		
<code>KbdCharIn</code>			✓
<code>KbdGetHWID</code>	✓		
<code>KbdRegister</code>			✓
<code>VioGetConfig</code>			✓
<code>VioGetMode</code>			✓
<code>VioGetState</code>		✓	
<code>VioSetCurType</code>			✓
<code>VioSetMode</code>			✓
<code>VioSetState</code>		✓	

Figure 1: Some kernel API functions in OS/2 1.2 are new; others have changed. `DosQProcStatus` is an undocumented function that supports process status and system information utilities such as `PS.EXE` and `PSTAT.EXE`. Note that functions that were actually changed in OS/2 1.1 but were not documented until OS/2 1.2 have been omitted here.

The existence of `DosOpen2`, `DosFindFirst2`, and `DosMkDir2` will have a significant impact on the complexity and size of virtually every application program. If you want to write a program that will run under all versions of OS/2 to date but that will still take advantage of extended attributes

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in an OS/2 1.2 environment, you will have to obtain the OS/2 version number during your program's initialization sequence and then perform runtime dynamic linking (using `DosLoadModule` and `DosGetProcAddress`) to bind your program to `DosOpen` or `DosOpen2`, `DosFindFirst` or `DosFindFirst2`, and `DosMkDir` or `DosMkDir2`, as appropriate. Presumably all this will eventually happen automatically in the runtime libraries for high-level languages, but the overhead in memory and execution time (plus the indignity of not letting the loader do the job it was designed for) will still be there.

The new functions `DosFSAttach`, `DosQFSAttach`, `DosFSctl`, and `DosShutDown` are specifically concerned with OS/2's support for installable file systems. `DosFSAttach` is a sort of explicit mount call. It allows an application program to override OS/2's automatic, dynamic mounting mechanism in order to associate a specific logical unit with a specific installable file system.

The `DosQFSAttach` function provides the converse service: it allows an application program to query which installable file system is in control of a particular logical drive. The `DosFSctl` is analogous to `DosDevIOctl`. `DosFSctl` function provides a direct path of communication between an application program and an installable file system. Similarly, `DosDevIOctl` allows an application to send commands directly to or obtain information directly from a device driver.

Finally, `DosShutDown` is the API surrogate of the ShutDown menu item in the DeskTop Manager; it can be called by an application program or demon process that suspects something terrible is about to happen to the system.

With this brief overview behind us, we can plunge into a more thorough investigation of OS/2. Next time around we'll begin to get into the nuts and bolts of the environment, and we'll begin to develop some useful code.

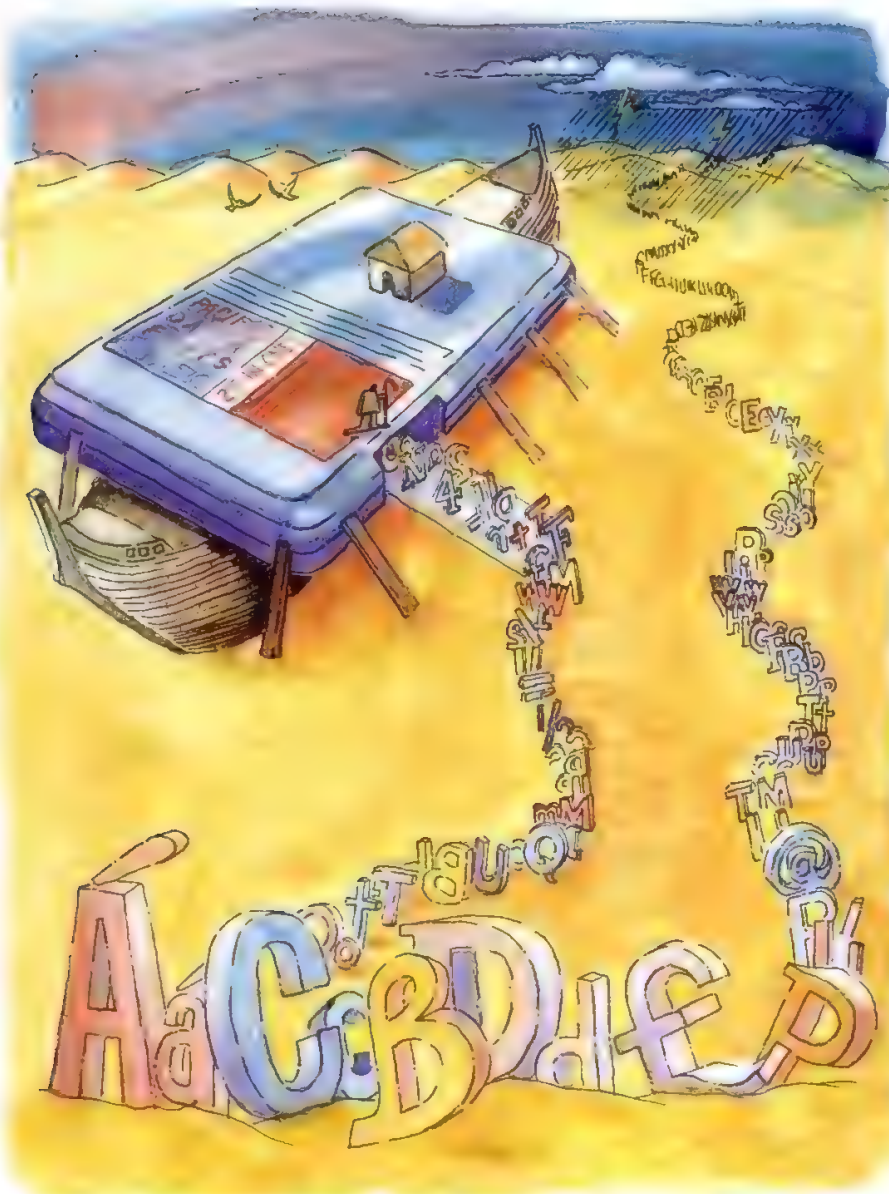
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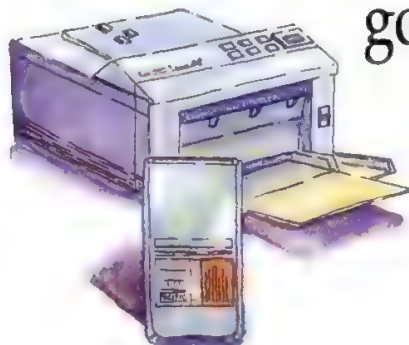
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SPREADSHEETS BORLAND STYLE

The spreadsheet arena has been quite lively these days. The last 12 months has seen the arrival of about a half dozen major new products, all of them offering either three-dimensionality, worksheet file-linking, or both.

Meanwhile, the near future holds at least two exciting new graphical spreadsheets for the OS/2 market. Indeed, these products—*Wingz* and *Lotus 1-2-3/G*—might even have arrived by the time you read these words. However, exciting times can also be confusing, particularly for those who now use *1-2-3*, Release 2.01, or one of its clones. Should you stay put? Upgrade to one of the two newest versions of *1-2-3*? Or should you jump the Lotus ship altogether?

To help you wrestle with the abundance of questions and options, I will occasionally devote this column to descriptions of the major new spreadsheet products. In the first two issues of 1990, I focused on *1-2-3*, Release 3. Similarly, this installment and the next will highlight prominent features of *Quattro Pro*.

PRODUCT PHILOSOPHY

Essentially, *Quattro Pro* is a file-linking spreadsheet program that's stacked with presentation features and user conveniences. Like *Quattro 1.01*, *Quattro Pro* is a system that can be made to feel and behave very much like *Lotus 1-2-3*. In the former, .WK1 files can be saved and loaded without recourse to a translation utility, and both the menu tree and the confirmation prompts can optionally be set for hand-in-glove compatibility with *1-2-3*, Release 2.01. Furthermore, users with *1-2-3* keyboard patterns burned into their brains should be able to operate *Quattro Pro* in a "heads down" fashion without getting homesick for their usual program.

THE LOOK AND FEEL

Approaching *Quattro Pro* "heads up" is a different story. Visually, *Quattro Pro* has more in common with *Microsoft Works* than with *1-2-3*. Menus—both *Quattro*

■ Overwhelmed by the deluge of spreadsheet alternatives? Perhaps our two-part investigation of Borland's *Quattro Pro* can begin to help.

Pro's own and the optional *1-2-3* set—drop down and cascade SAA (System Application Architecture) style. The program's worksheets are displayed in character-mode windows that can be zoomed, unzoomed, moved, sized, stacked, and tiled; you can keep as many as 32 worksheets in memory at once; 3 worksheets share the screen in Figure 1. And if you have a mouse, *Quattro Pro* augments the menu tree with a customizable icon palette. You can also bypass menu commands and use the mouse to change the size and position of windows and column widths.

Quattro Pro runs in graphics mode with an EGA or VGA display. In graphics, some of the graph menus are displayed gallery style (as in *Excel*). And while the program runs most quickly in character mode, the graphics mode lets you view live

graphs on the worksheet. Unlike *1-2-3*, Release 3, which displays graphs and worksheets together by opening a "graph window," *Quattro Pro* lets you stake out actual worksheet ranges for graphs—a far more satisfactory arrangement, particularly when it comes time to print. Without an EGA or VGA monitor, you can still put graphs on worksheets and print everything together on the page; you just won't see numbers and graphs together on-screen.

CLASHING WITH 1-2-3

Unlike *1-2-3*, Release 3, *SuperCalc 5*, and *VP-Planner 3D*, *Quattro Pro* doesn't provide true three-dimensionality—the ability to create worksheets with multiple pages and to define ranges across pages. Instead, like *Microsoft Excel*, *Quattro Pro* uses an unusually flexible file-linking system to unite worksheets. With this approach, cells in one sheet can reference cells in others, and the target sheets do not have to be currently in memory. In addition, constellations of worksheets can be saved and loaded as "workspace" files.

Yet despite its want of true three-dimensionality, *Quattro Pro* seems uncannily well suited to exploiting most of Lotus's current vulnerabilities. The most obvious distinction is in their respective memory

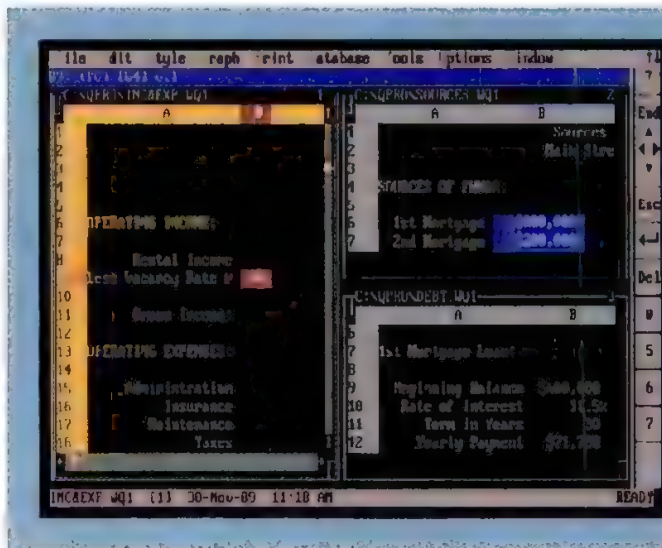


Figure 1: *Quattro Pro* displays up to 32 worksheet file windows at once. These windows may be tiled, stacked, or overlapped.

Spreadsheets

requirements. While *1-2-3* needs 1MB—and recommends at least 1.5MB—of RAM for the three-dimensional Release 3, *Quattro Pro* asks for no more than 512K of RAM.

Another *Quattro Pro* advantage is cosmetic. Lotus, unable to deliver *Allways* with Release 3.0, made users give up presentation output to get the advantages of 3-D. Conversely, Borland packs *Quattro Pro* with line-drawing and shading commands, a drawing tool for dressing up graphs, a slide-show generator, a print previewer, support for HP and PostScript fonts, as well as three Bitstream font outline families (Swiss, Dutch, and Courier) and an engine that builds bitmaps on the fly in sizes from 6 to 72 points. And if you've got additional Bitstream outlines, *Quattro Pro* will install them and add the fonts to its menus.

As if its face weren't pretty enough, *Quattro Pro* includes an elaborate DOS shell—a shell at least as good as the one that comes with DOS 4.0—and a module for solving linear optimization problems.

CONFIGURING FOR QUATTRO PRO

The reason *Quattro Pro* requires only 512K RAM is because it swaps small overlays in and out of memory as needed. This means you never have to cough up a whole functional module (graphing, for example) simply because you're low on memory.

If you're running a 1MB system, Borland recommends you disable any EMS drivers and start *Quattro Pro* with the /X switch. That enables the program to use up to 512K of extended memory for caching its overlays. The company also strongly advises you to get rid of any RAMdisks or disk cache drivers that use extended memory when you initialize with /X.

If you have an EMS driver and more than 1MB of memory, Borland recommends that you forget the /X switch and instead use your expanded memory. The program supports up to 8MB of LIM 4.0 EMS memory, and it does so with characteristic flexibility. By default, it uses expanded memory only as needed for worksheet data, while leaving formatting information in conventional memory to improve performance. However, *Quattro Pro* gives a variety of alternatives with the /Options | Other | Expanded Memory command. You can tell the system to put

everything into EMS (thereby allowing you to keep more data on-line); or you can put just formatting information into EMS and keep cell data in conventional RAM; or you can disregard EMS altogether.

While *Quattro Pro* does not offer virtual memory, its file-linking features let you create multiworksheet models larger than your available memory space.

USER INTERFACE

Quattro Pro's interface asks the user to make two basic decisions: which menu tree to use and whether or not to hire a mouse.

If you're migrating from *1-2-3* or if you use *Quattro Pro* in a workgroup with Lotus users, by all means install the *1-2-3* compatible menu tree. You can do this via the setup program when you first put the program on-disk, or you can use the /Options | Startup | Menu Tree command.

Quattro Pro includes shading commands, a drawing tool to dress up graphs, and lots of font support.

With the *1-2-3* menus in place, *Quattro Pro*'s /File commands read and write .WK1 files by default.

I have one warning about the *1-2-3*-compatible menu tree: *Quattro Pro* has a lot of commands with no *1-2-3* equivalents. These extra options are appropriately tacked onto the ends of menus in the *1-2-3* tree, but some of them are pretty hard to find or remember. There is one option that you should learn immediately and always remember: /Worksheet | Global | Default | Files | Menu Tree. This is the command that takes you back to the native *Quattro Pro* menus, and, oddly enough, you can roam the Borland manuals for a long time before you find it.

While the menu question is a matter of Lotus, the mouse question is a matter of preference. As a loyal typist, I have used *Microsoft Word* for years with my mouse lying idly by, despite all claims for its value as an editing instrument. So I was surprised to find a mouse useful with *Quattro*

Pro, particularly for moving between worksheet windows, customizing graphs, and selecting ranges. Do you want to kill a few columns of data? Just wave the mouse and press Del. You may not, however, want to mouse your way through lists and across worksheets because Borland has inexplicably made the scroll bars tick; and they sound like some of those early word processors that tried to imitate typewriters.

As helpful as a mouse may be, though, it is indispensable only if you make extensive use of the graph annotator. For other work, even the most grueling spreadsheet tasks, you can do well without it.

LINKING FILES

As noted above, *Quattro Pro* offers a well-developed set of file-linking tools. When you link files, you're current worksheet is the calling or *primary* file, while the one from which you're extracting data is the *external* file.

To reference a cell or range of cells outside the primary file, include the external filename in brackets, as follows:

```
@SUM([JANUARY.WK1]D12..D16)
```

The primary file in an external reference must be a native *Quattro Pro* (.WK1) file, but the external files can be in the format of any spreadsheet that *Quattro Pro* supports (*1-2-3* 1A, 2.01, 2.2, or from *Symphony*). Thus, multivendor (that is, Borland/Lotus) workgroups are not a problem from the *Quattro* user's perspective. The targets of external references can be constants, formulas, labels, or even other external references. Thus you can make external references indirectly, by referencing formulas in a link library. If several primary files call the same link-library cell, they can all be modified at once by a single change in the link library.

If the external file lives in a different directory from the primary file, you must include a path specification. And if the external file is open in memory, you can just point to it and *Quattro Pro* will take care of the typing for you. If, however, the file is not in memory and *Quattro Pro* can't find it on-disk, the program will generate a "File not found" message and then give you a chance to edit the filespec. To do this, Press Esc and *Quattro Pro* gives you a list of worksheet files in the specified directory. Press Esc again, and the program assumes your external file isn't ready yet, and it returns the value NA for your formula. This last option is handy; it means



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Spreadsheets

you're free to build consolidation logic even before all the pieces are in place.

To simplify positional consolidation, *Quattro Pro* lets you include wildcards in external file specifications. For example, if you write

```
@AVG ([*]J14)
```

Quattro Pro will give you the average of all the J14 cell values in all the files currently open in memory. Obviously, if you're using wildcards, you should be loading and saving workspace files so you know exactly what files are open at all times.

When you load a file that contains external references, *Quattro Pro* asks if you want the supporting worksheets loaded as well; a yes answer brings them all into memory. If you don't want them loaded, *Quattro Pro* will either update all the external references without loading or return NA values—as you choose. At any time while you work, you can use the /Tools | Update Links | Refresh command to update some or all references to files not in memory. The /Tools | Update Links menu also has a command for modifying references to external files—handy in case you change the name of a target file or just want to point your references to a different external data set.

LINE DRAWING AND SHADING

Quattro Pro's Style menu (/Range | Style on the 1-2-3 tree) includes commands for drawing lines, applying shading, and choosing fonts. The shading and line commands make it easy to set off subtotals and totals, to put borders around graphs, and, in general, to call attention to areas of the worksheet by highlighting them.

Quattro Pro offers three line styles: single, double, and thick. The shading options are merely gray and black, and, unfortunately, the gray dot pattern (as output on my LaserJet II) is too coarse to be useful. *Allways* (for 1-2-3) does a better job in the shading department.

FORMATS

The other major vein of the Style option provides access to *Quattro Pro*'s huge selection of fonts. As mentioned earlier, the program supplies Bitstream Swiss, Dutch, and Courier typefaces, and it also builds

the bitmap files for various point sizes as needed. Also supported are the nine non-scalable Hershey fonts included with *Quattro* 1.01, as well as 37 PostScript fonts and most of the HP cartridge fonts. Even those who can't take advantage of the HP or PostScript faces will still have plenty of options. The program lets you use up to eight fonts on a worksheet at once, and you can arrange the fonts any way you like.

Quattro Pro's strategy is to reserve on-screen font display for graphs and the print previewer. Even when running in graphics mode, you never see anything but the monospaced system font on your worksheet. You know the location of various fonts only through the appearance of codes on the edit line. For example, F8 would indicate font number 8.

The print previewer itself uses the zoom option to enlarge the image up to 400 percent, and thus you can get a pretty accurate picture of the end product. Unfortunately, you'll have to toggle back and forth from worksheet to previewer in order to fine-tune your work.

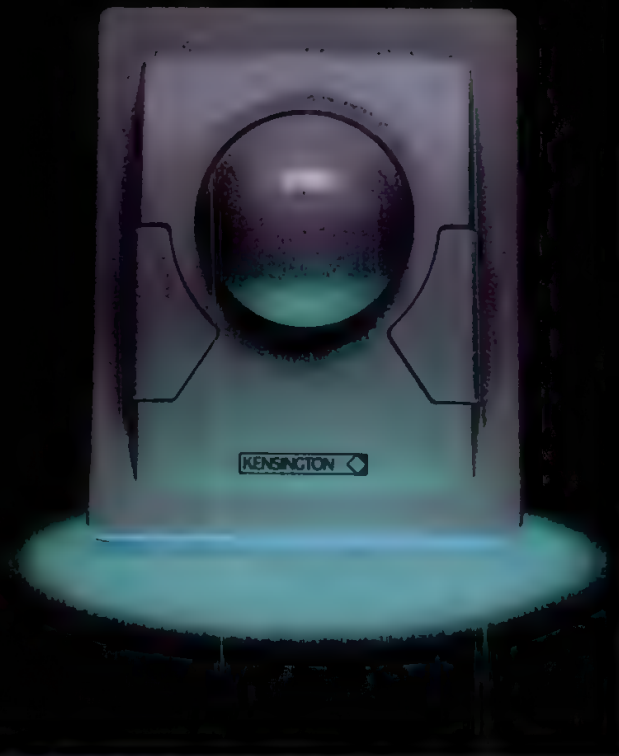
There is a disappointing side to the previewer and the graphing capability: you'll have to wait while *Quattro Pro* builds a Bitstream font file. This can drive you crazy, particularly when you're starting out with the program. But, as long as you have ample disk space, you'll build a library of font files on-disk as you work; so the longer you use the program, the less often you'll have to wait.

Quattro Pro's own files in addition to a decent library of bitmap font files will monopolize about 4MB of hard disk space. If that's more than you can afford to give up, you can turn off the font-building capabilities to avoid delays. When font building is deactivated, *Quattro Pro* uses its Hershey fonts—which display instantly—to stand in for any Bitstream choices you've made. And you can still get Bitstream output in the end by turning the font builder back on when you print.

HINTS, TIPS, QUESTIONS

Share your latest spreadsheet discovery through *Spreadsheets*. We'll pay you \$50 or more for tips we print, plus an extra \$25 if you submit your letter on a disk. If you do, please include a printed copy. Mail contributions to *Spreadsheets*, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column).

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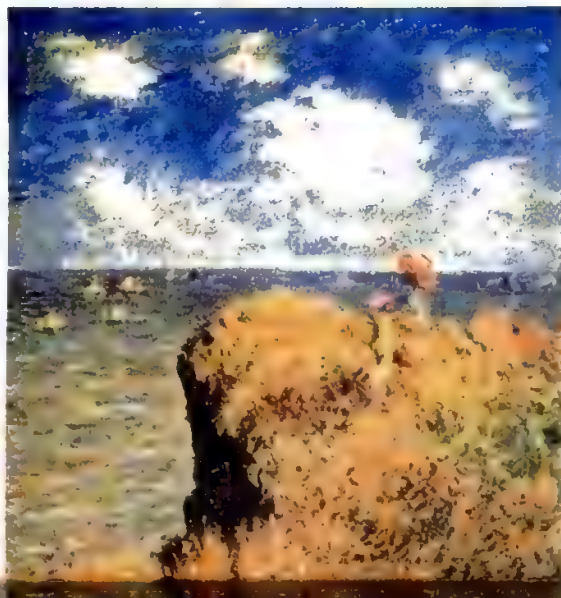
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by
Craig L. Stark

The Working Word

WORD FOR WINDOWS: OF MICE AND MENUS

Most readers spend more hours at the PC with word processors than with any other kind of application, so we've decided to turn that portion of our former Power User column into a separate entity: The Working Word. Naturally, we'll publish those ingenious reader-submitted macros and workarounds that have made Power User so popular. As a separate word processing column, however, The Working Word will provide an additional opportunity to take an editorial look at new word processing applications, ancillary programs, and developing trends whose implications will affect every reader who works with words.

One such trend is the increasing integration of graphical elements with word processing, a trend epitomized by Microsoft's recently released *Word for Windows*. The *Windows* graphical environment gives this new incarnation of *Word* many of the capabilities of a page-formatting program such as *PageMaker* or *Ventura Publisher*; it also can display, while you edit, how your text looks in Times Roman, Palatino, and a variety of other typefaces that you used to have to wait for your laser printer to crank out.

Overall, I found *Word for Windows* an enormously impressive product, especially when considered in the corporate context that is its natural setting. A detailed examination of some of its features must be deferred to a subsequent column, but even a mere enumeration of some of its features is proof enough that *Word for Windows* is as flexible and powerful a word processor as you're likely to find.

- A print-preview procedure allows you to see the overall page layout, a two-page spread, or a view of as much of your text as will fit on-screen.

- You can create tables including text and graphical elements automatically and with amazing ease. Once it's created, you can then customize a table's appearance and the contents of each of its "cells" to suit your specific requirements.

■ **WORD FOR WINDOWS:
OF MICE AND MENUS**
A generally impressive
application points the
direction in which word
processors are evolving.

- For insertion and placement of pictures in the TIFF file format, *Word for Windows* treats the pictures as if they were ordinary characters. Once inserted, however, images can be scaled and cropped, and text flows around them automatically.

- Not only can you cut-and-paste spreadsheet data into your document via the Clipboard, but (at least with *Microsoft Excel*) you can form an actual live link that automatically updates the information of one program based on changes in the other!

- Document templates and style sheets simplify the task of maintaining formatting consistency and can be modified easily using pull-down windows. (While I find menu-based procedures in general—and *Word*'s "select, then apply" formatting method in particular—a nuisance, many users will consider these among the program's most appealing features.)

- Macro creation and editing have been enormously simplified, while the macro programming language (called WordBASIC) has been expanded. Macros can be assigned not only to key combinations, but also to the pull-down menus.

- Glossaries—Microsoft's term for what other word processors usually call keystroke macros—can include pictures as well as boilerplate text.

- Multiple annotations and revisions can be separately made, tracked, and compared using a split-window technique (called *panes*). Document reviewers may be barred from making changes, and a document summary (including time spent editing) can be maintained.

- The document summary is used to provide full search facilities by filename or

text, though the multitiered procedure seems rather cumbersome.

- Up to nine documents can be kept active simultaneously, with full copying and moving facilities for graphical elements and text.

- Scientific and mathematical equations can be presented on-screen and solved from within the program (see Figure 1).

- A nine-level outlining facility will help users organize their thoughts and their documents. Sections can be "promoted" (shifted a notch to the left in outline form) or "demoted," sentences can be made into headings, and the display can be switched to show only information of a certain level or above.

- Spell-checking, thesaurus, mail-merge, indexing, tables of contents, figures, footnotes, and endnotes—all the accoutrements of full-featured word processors—are supported. So is an enormous list of printers, though an HP LaserJet is required for some features.

THE GRAPHICAL CONNECTION

With all this going for it, what more would I want from *Word for Windows*? Leaving aside my personal antipathies toward mice and menus, I find the program unacceptably weak in actually working with words. Paradoxically, the graphics environment that gives the program so much of its strength is also its Achilles heel.

No one doubts that printed books and the Times Roman fonts produced on a laser printer are easier to read and more aesthetically satisfying than typescript copy and the monospace screen displays of traditional character-mode word processors. Graphically based applications such as *Word for Windows* offer the possibility of visual high fidelity, usually dubbed "true WYSIWYG" (what you see is what you get).

When you're *working* with words, however, it is not a foregone conclusion that true WYSIWYG screen display—or even printout—is desirable at any point short of the "dress rehearsal" stage. As

The Working Word

readers who have followed the sometimes heated debates on the subject on PC Mag-Net will know, this can be an emotionally charged subject. But here, from my own experience in working with editors at all levels at *PC Magazine*, are some of the situations in which it is not:

- Missing or erroneous punctuation marks are far easier to detect in a monospace than in a proportionally spaced environment. Moreover, for copy editing, missing underlining is easier to spot than the absence of true italics.

- Where copy must be marked, double-spacing is mandatory, and headline fonts, while they should be larger than body copy, should generally not be as large as they will be in print.

- Editing a printout in 10-point Times Roman (the size that appears in *PC Magazine*) is ridiculous. A slightly scaled-up, 12-point representation (with column widths correspondingly widened) is far easier to work with than true WYSIWYG.

Additional problems with WYSIWYG arise when you do your editing at the screen. For one thing, even VGA screens today provide nowhere near the necessary resolution for reading small type sizes. The use of "Greeking" for small point sizes is universal, but you can't very well edit that. *Word for Windows*' help screens seem to be displayed in an 8-point Helvetica type that I find desperately hard to read. (Microsoft seems to be aware of this problem, as it provides a page-printout option for the program's help screens.)

Indeed, I find even the 10-point default

(NORMAL.DOT) Times Roman screen font used by *Word for Windows* very tiring on my over-40 eyes, and in either 10- or 12-point Times or Helvetica, the screen resolution makes words like *little* significantly harder to read than monochrome, EGA, or VGA monospace fonts. (Positioning a mouse cursor properly within such words is also very difficult.) All this translates into more time spent editing at the graphics-based screen than if you were working in character mode.

Even on a 25-MHz 386 machine, I find that speed is still the great drawback of graphics-oriented applications. Microsoft has done a commendable job of speeding up screen updates in *Word for Windows*, but again and again I found myself waiting for the display to catch up—sometimes long enough for the hourglass icon to appear. The moment you become aware that you're waiting for the computer, you've broken your concentration, as Martin Buber would phrase it, your "I-thou" relationship with your words has popped back into the everyday "I-it" relation.

This is a problem that will continue to bedevil writers and editors who attempt to edit in graphics mode rather than character mode, even when the resolutions of screen displays improve. Doubling the resolution involves squaring the number of screen pixels that must be turned on or off.

The present answer—incorporated in *Word for Windows*—to the screen resolution/screen speed problem is the provision of (you guessed it) a monospace draft-mode screen font. The program provides no handy keyboard shortcut to switch between draft and page display modes, so you have to go up to the menu to do so. You can, however, construct your own

macro to assign this function to a key.

I found *Word for Windows*' sans serif draft-mode screen font both more readable and faster in displaying than the graphical screen fonts. I also found, however, that in toggling between draft and page modes, the display was often reset to the beginning of page 1, and that the draft-mode printout still came out in Times Roman. (I was working with a prerelease copy, and presumably these small bugs will have been swatted in the final version.)

Draft mode makes entering and editing text easier, but it doesn't provide a fully satisfactory solution. In draft mode, all character attributes (italics, boldface, and others) in *Word for Windows* are displayed as underlined. Even the old green-screen monochrome PC did better than that, and I find it convenient to display different attributes with different colors: red for italics, white for bold, blue for superscripts, green for subscripts, and so on.

More serious, however, is that the line breaks on the monospace draft font do not correspond to the line breaks of the typeface they are nominally replacing. Of course, not all character-based word processors use their printer-font-width tables to show true line breaks on a character-based screen. But some do, and this is an absolute requirement for my editing, at least. I must know whether a given headline or subhead will fit in the one, two, or three lines allotted to it. You can do this in *Word for Windows*, but only at the cost of shifting to the less-readable graphics-based screen.

The 1989 treaty protocols between IBM and Microsoft divide the PC world of the future into the *Windows* sphere of influence (all PCs with up to 2MB of RAM) and the OS/2 Presentation Manager domain (all PCs with more than 2MB of RAM). Since both of these application environments are graphics-oriented, the direction that future word processors will likely follow is clear. So, too, are some of the problems this creates for those of us who make our living working with, and not merely arranging, words.

TIPS FROM WORKING WORDSMITHS

Tell fellow users about your latest word processing tips, and we'll pay you \$50 for any tip we print. Please send your letter on-disk along with a printout. Mail your contributions to The Working Word, *PC Magazine*, One Park Avenue, New York, NY 10016.

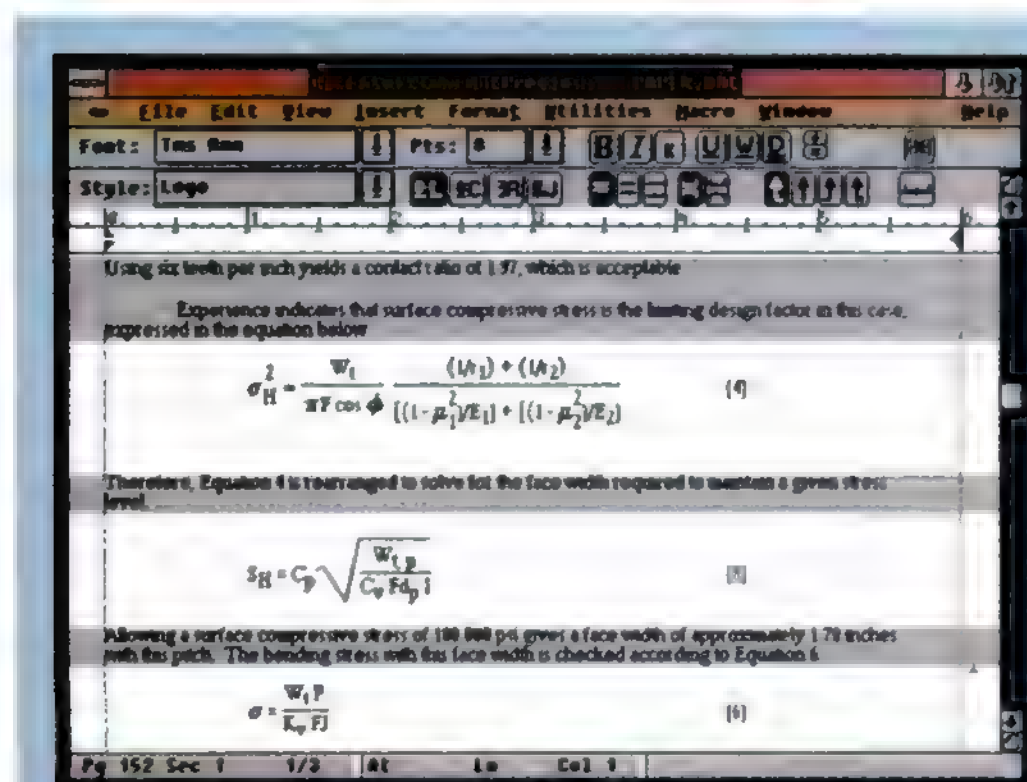


Figure 1: One of the advantages of a graphically based word processor is that it can display mathematical equations as easily as text.

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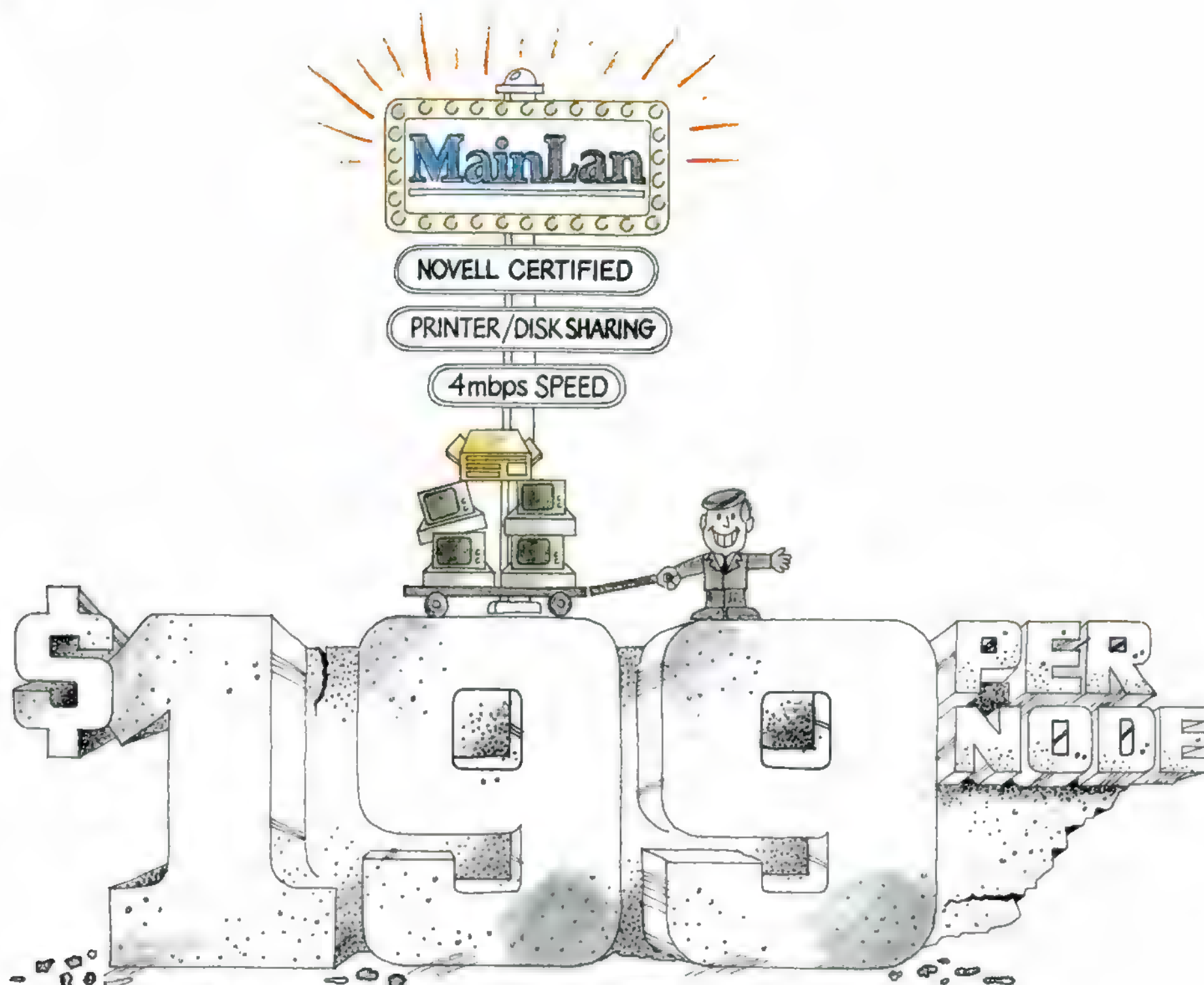
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Connectivity

CREATING LINKS

Connectivity often involves linking large complex systems, but sometimes the connections can be much simpler. In any case readily accessible information makes implementation an easier process.

LOW-COST LINKS FOR LAPTOPS

You can easily make your laptop PC a full participating member of high-speed networks and IBM SNA computer systems through special adapters. But if you only need to connect your laptop to other computers for file transfer, electronic mail, and printer sharing, don't forget to look at data switches as a connection scheme. Data switches represent a simple and low-cost way to link laptops, Apple Macintosh computers, PCs, other computers, and peripherals throughout one or many offices.

Laptops, as well as other PCs and devices, hook up to the data switch through their RS-232C serial ports. Then the switch, in response to a few characters received down the serial line, connects any two available serial ports together. Once connected, the laptops, PCs, Macintoshes, and other computers can exchange files, share printers and modems, and handle other tasks simply and efficiently. After a task is done, just disable the connection and you're ready for another one. The cost for a data switch is typically \$100 per port. The best systems include TSR software, which makes it easy to connect and move your data.

You won't go wrong with a data switch from Buffalo Products ((800) 345-2356), Digital Products ((800) 243-2333), Fifth Generation Systems ((800) 873-4384), Newbridge ((703) 834-3600), or Rose Electronics ((713) 933-7673). The switches differ in size, features, and accessory software, so shop around to find the best answer for your laptop connection needs. For more information, see our review of data switches in the July 1989 issue of *PC Magazine* ("Data Switches: A Low-Cost LAN Alternative").

■ **CREATING LINKS:**
Here's more information
on connecting large
and small systems,
and on creating and
using infobases.

LINKS FOR LARGER SYSTEMS

Even if yours is not a "DEC shop," consider DEC as your PC network integrator. A high-powered VAX minicomputer acts as a server for a network of PCs running DOS or OS/2 in the DEC PCLAN/Server 3100 system. This system provides gigabytes of storage and, of course, smooth integration into networks of larger DEC computers. We reviewed the PCLAN/Server 3100 in the January 16, 1990, issue of *PC Magazine*.

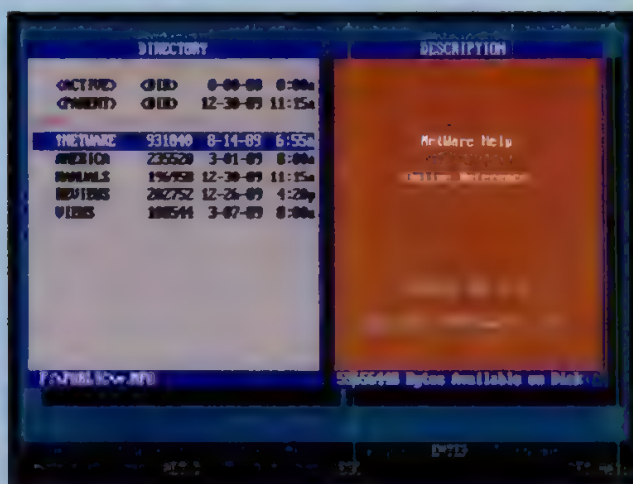
A significant advantage of this system is that DEC will "hold your hand" during the entire process—from selecting PCs through naming users on the installed network and on to maintaining the hardware. In fact, until the middle of this year, DEC will sell you a complete DEC PCLAN/Server 3100 with soup-to-nuts installation and a money-back guarantee at a considerable

discount from the original price.

The DEC PCLAN/Server 3100 is an even better deal now that DEC has improved the performance of its server software. When we first ran the DEC server at PC LAN Labs, we saw a lot to like, but we also moaned over the performance. The software retrieved big file chunks (4K or more) just fine, but it moved slowly when asked to retrieve data in 512K blocks and smaller.

The marketing people at DEC finally wrote a performance specification for the engineers to meet, and then they returned to the LAN Labs to demonstrate Version 3.0 of the PCLAN/Server 3100 software. The new software showed an increase of nearly seven times in throughput on some tests. The PCLAN/Server 3100 always held up to a heavy load with little performance degradation, but the new version gives it a faster basis from which to start. DEC seems to be serious about PC networks. DEC relabels Tandy's PCs, installs more Ethernet than anybody, and can provide any degree of support you want. If you haven't yet investigated DEC, perhaps it's time to take a look. It's hard to go wrong with a money-back guarantee from a company this size! Call (800) DIGITAL for more information.

Figure 1: The NetWare HELP utility is actually a program called PreVIEWS. This screen shows two infobases, Reviews and Manuals, that we created and added to our servers at PC LAN Labs. Network users can follow the hypertext links through our locally compiled information.



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Connectivity

CREATE YOUR OWN INFOBASE

NetWare users appreciate the HELP system Novell includes in its current packages. When you type HELP (assuming you have a search drive mapped to the PUBLIC subdirectory on the server), a screen pops up to lead you through the electronic equivalent of the Novell manuals. The sign-on screen tells you that the HELP system is a product of Folio Corp. of Provo, Utah.

When you ask for HELP, you're actually running *PreVIEWS*, Folio's infobased search software. An infobase is an indexed and compressed image of text files with hypertext links. This means you can find, link, and read related elements in the text even if they weren't originally sequenced together. You can follow chains of thought linking related items throughout the text and use typical Boolean operators such as AND or OR as well as wildcards to locate information.

The Folio *PreVIEWS* package contained in *NetWare* is interesting for two reasons: You can build other infobases from ASCII files containing information unique to your organization and read them through the Novell HELP program you already have. And, if you have the heart of an entrepreneur, you can create and market infobases that the people with access to the quarter of a million *NetWare* file servers already containing *PreVIEWS* can read. This is a significant ready-made market for developers.

However, the *PreVIEWS* package included in *NetWare* doesn't give you authoring capability. It's just a reader or search engine. You need another package from Folio called *VIEWS* to create the infobase. *VIEWS* indexes every word in the text and then crunches it all down to about half the size of the original text.

There are other products with similar capabilities. However, none have the unique installed base that Folio gained through its bundling with *NetWare*. You can spend \$495 for *VIEWS* and create infobases to distribute or sell to anyone with a current copy of *NetWare* and have no further costs for a runtime text reader program. The *PreVIEWS* product in *NetWare* is already set up to accept new infobases.

Every company developing or marketing *Netware*-compatible products should run the text of its manuals through

VIEWS and distribute the resulting infobase with instructions on how to load it into the PUBLIC subdirectory. If you're a *NetWare* system administrator, you can put your own organization's operating procedures, manuals, and other information on the network for easy search and use. Figure 1 illustrates what we've done at PC LAN Labs.

People don't have to be experienced computer users to benefit from an infobase. Be creative! Put a diskless network workstation in the coffee break room with access to the organization's employee handbook, profit-sharing plan, benefit plan, procedures manual, and safety information in infobases. Making information readily available to the employees can create a more productive atmosphere.

If you are faced with an ugly stack of documentation for some *NetWare*-compatible product, ask the sales rep for the infobase. If the company intends to compete in this market, it should have one.

And if you want to wake up this giant sleeping market, call Folio Corp. at (800) 873-3654 to learn more on *VIEWS*.

NETWORKED CD-ROMS

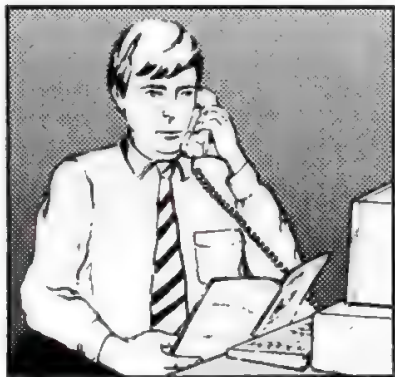
In the February 27, 1990, issue of *PC Magazine*, we reviewed alternative ways to install CD-ROM devices on a network ("Networking CD-ROMs"). Sharing a CD-ROM infobase is one good reason for installing a local area network. The Bureau of Electronic Publishing is a retailer of infobases published on CD-ROM. It recently established an on-line dial-in service that includes the ability to use certain infobases for a short period of time in order to sample the wares before you make a purchase. I guarantee you'll be interested. Call (201) 808-2700 to get a password for the on-line database.

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Connectivity gives you practical solutions to networking problems of all types. We'll pay \$50 or more for any tips we print, *plus an extra \$25 if you submit your letter on a disk*. If you do, please include a printed copy. We'll gladly answer your questions at no charge, but we cannot answer letters personally. Mail contributions to Connectivity, *PC Magazine*, One Park Ave., New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). You may also contact Frank J. Derfler, Jr., via MCI Mail (use Derfler's box named PC MAGAZINE LAN LABS).

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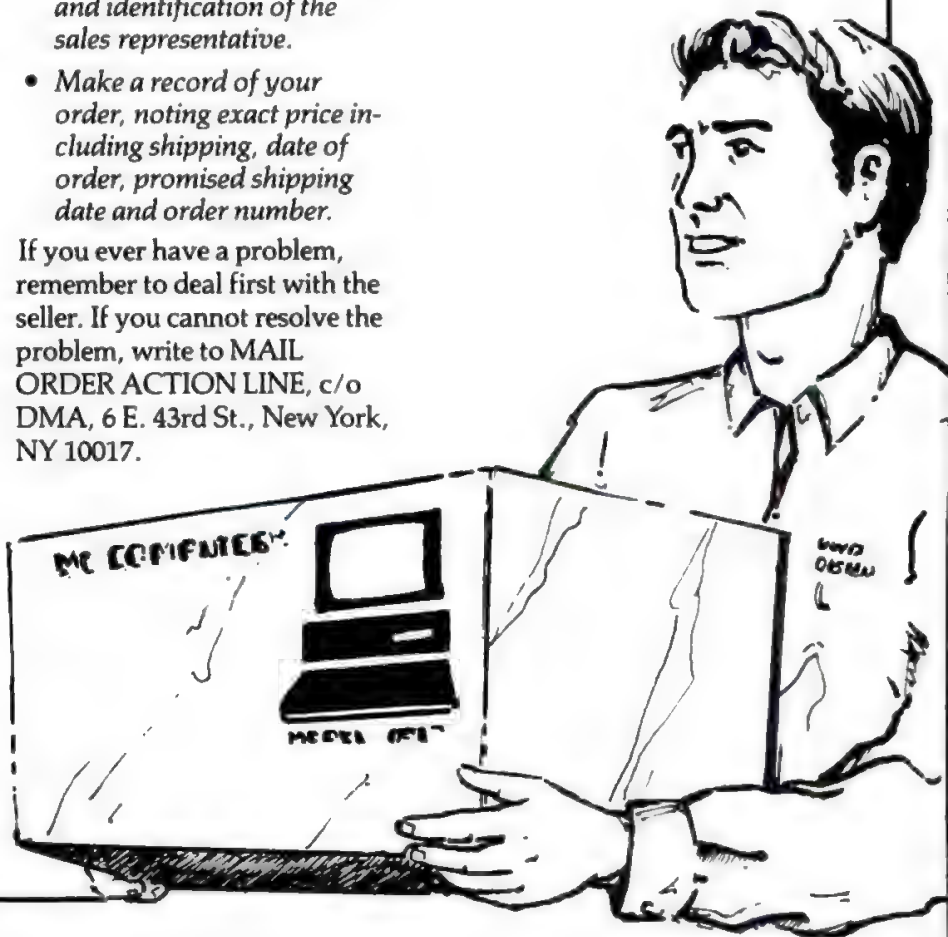
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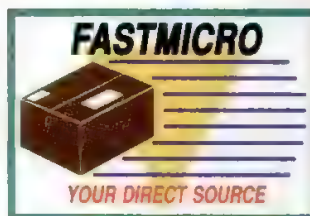
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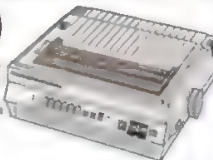
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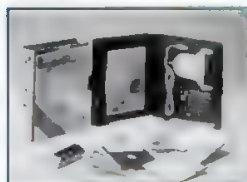
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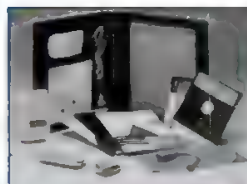
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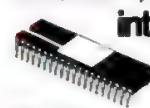
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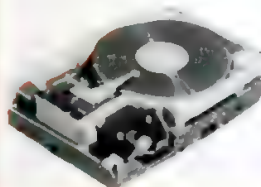


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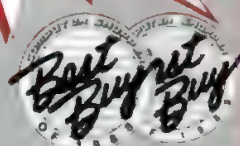
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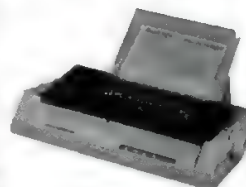
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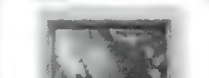
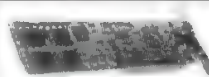
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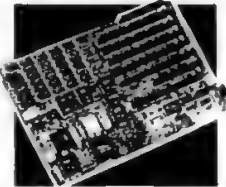
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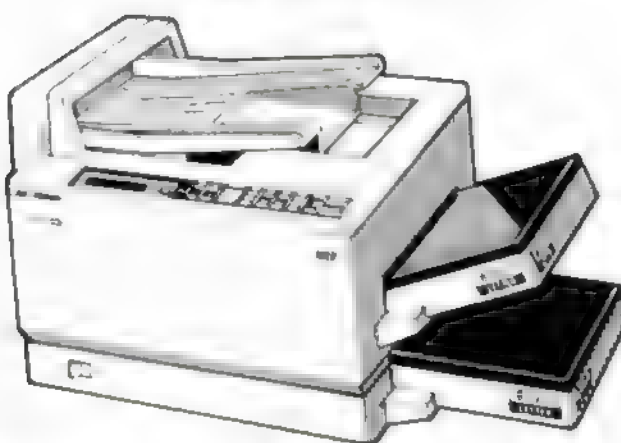
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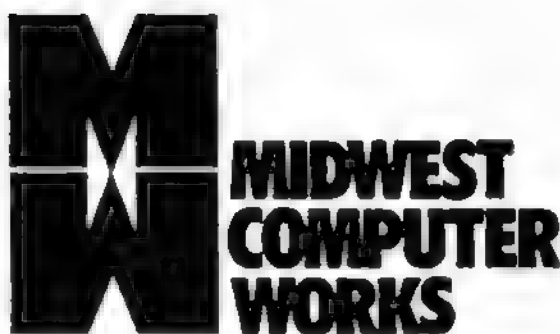
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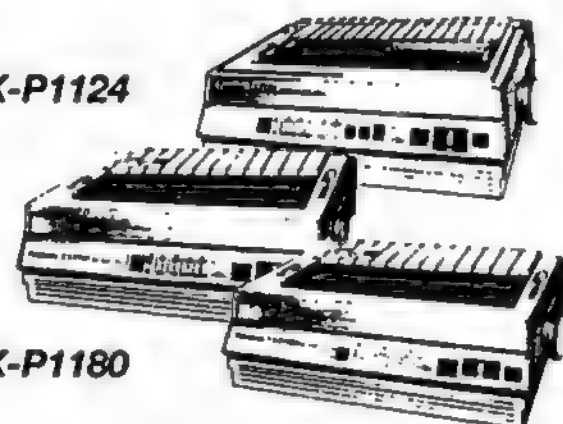
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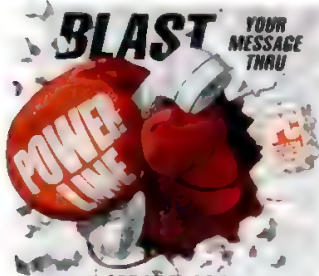
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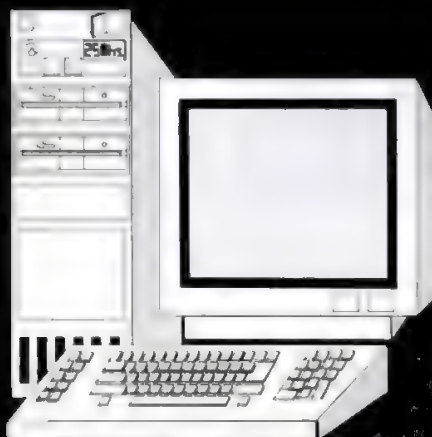
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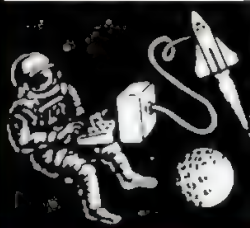
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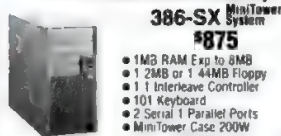
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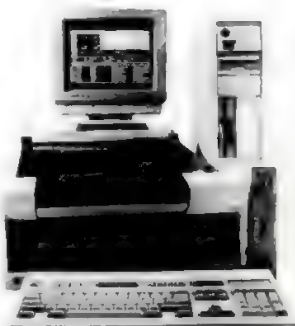
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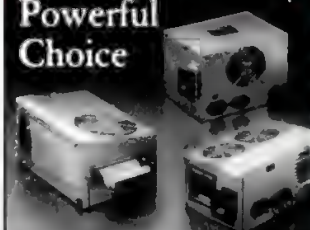
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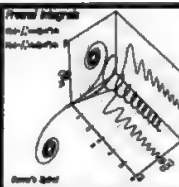
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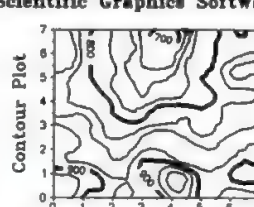
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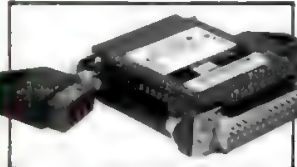
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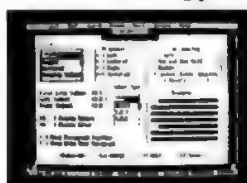
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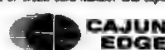
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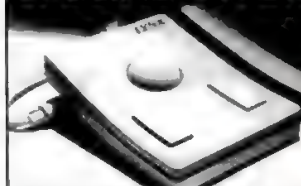
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After Hours

Products for the Leisure Side of Personal Computing

Leisure Suit Larry Meets Passionate Patti in Sierra's Latest and Lustiest

GAMES
by Lori Grunin

Poor Larry Laffer. First, in *Leisure Suit Larry in the Land of the Lounge Lizards*, he explored the seamier side of life in Lost Wages, Nevada. Then KGB agents hounded him in *Looking for Love (In Several Wrong Places)*, also known as *Leisure Suit Larry II*. Now Sierra On-Line has brought him back for even more punishment—just to amuse us heartless gamers—in *Leisure Suit Larry III: Passionate Patti in Pursuit of the Pulsating Pectorals*.

What lies in store for Larry this time? As in *Larry II*, our hapless hero gets dumped at the beginning of the game. Kalalau, his island bride, does the dumping this time around. After getting jilted, however, Larry doesn't go looking for love. Instead, our antihero sets his sights on cheap thrills. Goodbye Hawaiian shirt and shorts, welcome back white polyester suit.

Larry and his suit spend the first part of the game wandering around Nontoonyt (None-tonight) Island, the tropical paradise we last saw at the end of *Larry II*. Since then, the island has metamorphosed into Donald Trump's idea of paradise, complete with casino, health spa, and Dewey, Cheatem & Howe, Attorneys at Law. The noticeably paunchy Larry pumps himself up (we actually *do* get to see those pecs pulsate!) and entangles himself with various women whose names end in *i*.

About halfway through the game's 4,000 possible points, he meets Passionate Patti, whom you may vaguely recall from the end of *Larry II*. After a night of,

er, passion, Larry abandons Patti (for good reason), vowing to give up women forever, and disappears into the dreaded bamboo forest. Instead of taking this turn of events lying down, Patti pursues her fleeing lover through Nontoonyt's most rugged terrain, and beyond. The second half of the game is actually Patti's story.

There's one real maze and one arcade sequence, both of which you face as Patti. The maze is really a documentation-related puzzle, easily solved with the help of your copy of *Nontoonyt Tonight* and some mental gymnastics. Completing the arcade sequence is relatively easy, as long as you follow the rule of Sierra arcade action: save often! *Larry III* even incorporates an optional auto-save feature that will pop up and remind you to save your game if 5 unsaved minutes have gone by.

Larry III is in many ways the best of the series; the plot holds together better than in *Larry II*, and the characters are more interesting than those in the first installment. But if the game's premise is more interesting than those of earlier episodes, the puzzles didn't

tickle my "ooh, that's clever" bone quite as often. They are challenging, though I often found myself admiring the result in-

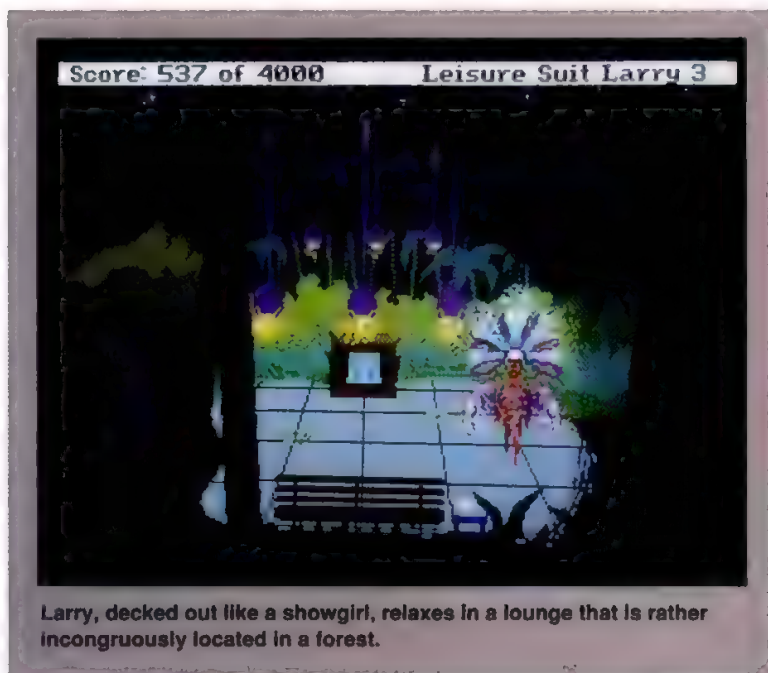
stead of the elegance of the solution.

This third in the series was eagerly anticipated as the steamiest *Larry* yet. Though the sex is far more graphic than in earlier installments, it's inoffensive and used to good effect. You'll witness a little jiggling, bumping, grinding, and proximate horizontal squirming—a lot less than I saw the last time I watched "Days of Our Lives" on TV. Oh yes, there's a little bit of nudity (both male and female), as well. Imagine, if you can, a two-inch animated character, naked, in 320 by 200 resolution. There ain't much there, folks. But it works, because the naughtiness amuses rather than titillates. With the exception of the opening exercise in voyeurism, the game lacks the sniggering locker-room tone that could



cared about the characters as much as the quest.

In deference to the faint of heart, Sierra has included "raunch protection," but it



make this sort of material insulting. In fact, I found Larry and Patti's brief interlude quite touching—for the first time in an adventure game, I actually

seems pretty halfhearted. There are five "filth" levels, which you access by correctly answering a given number of questions

CONTINUES

After Hours

Larry

CONTINUED

upon starting the game. Once you've properly answered all five questions (for the highest "filth" level) and saved that game, the same setting will be in effect when you restore the game. So if you feel you need to shield your kids' hands from the blue material, you'll have to find some other method.

The relatively low-resolution

that comes in the package contains not only crucial combinations and passwords that you need to play, but also clues that make the game a lot less frustrating at times.

Leisure Suit Larry III: Passionate Patti in Pursuit of the Pulsating Pectorals is an enjoyable, thoroughly amusing game with terrific integration of graphics and sound. Although some gamers are already crying out for a *Larry IV*, this hopeless romantic thinks it's time to pick on someone else and let poor Larry live happily ever after.

Hawks: 1942 vividly brings back the summer of 1940, when England was besieged by Nazi forces that had just ripped through most of Europe.

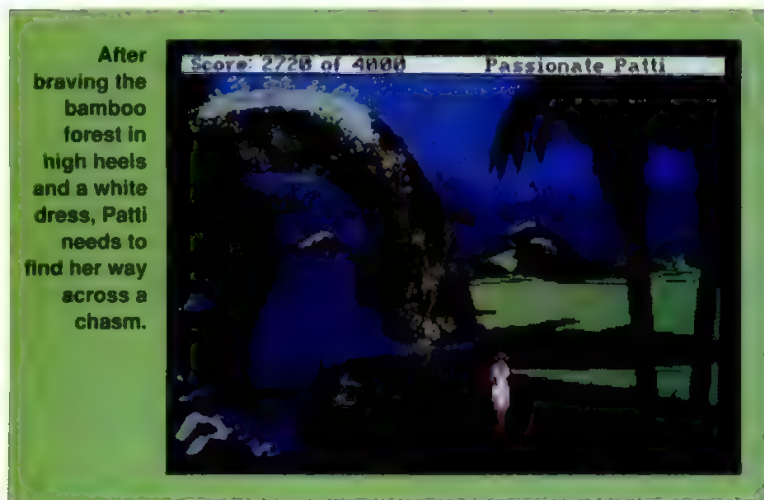
The Battle of Britain encompasses the events of July through September 1940. During this completely aerial battle, the British lost 515 of their brave fighter pilots and 842 aircraft. The Nazis lost more than 1,400 planes and failed to break the back of the island kingdom, in what came to be seen as a major turning point in the war. While you are playing *The Battle of*

In the course of play, you can fly either of the two types of fighter planes deployed by the British during the campaign. The more famous of the pair was the Supermarine Spitfire, which appeared in two versions. Somewhat lesser known was the Hawker Hurricane Mk I. With its reinforced metal frame and slightly larger ordnance capacity, the Hurricane was nearly an airborne tank.

If you decide to play on the German side, you'll find either BF-109 or BF-110 fighters available. The latter is nearly as fast as the Spitfire and may be used as a utility dive-bomber. Bombing missions open an entirely different arsenal to you. The fast and furious Ju 87B Stuka dive-bomber can handle light missions, while medium bombers are well represented by the Dornier Do 17Z-2, Heinkel He 11H-3, and the long-range Junkers Ju 88A-1.

It's up to you to train your pilots. They start life as Flight Officers or Lieutenants and, if they survive, progress to Group Captains or Obersts. During single-flyer training flights, you practice against a variety of opponents. Combat-training flights engage you and a squadron (either pilots you've created or raw troops supplied by the program) in running battles. The training flights are extremely important and teach you the basics of survival in the deadly skies.

Once you've honed your pi-



After braving the bamboo forest in high heels and a white dress, Patti needs to find her way across a chasm.

graphics still present problems. One scene with ostensible sexual overtones looked awfully innocent, even in VGA. It was similarly difficult to discern an important path in the forest.

If you own Roland's MT-32 sound module, you will be treated to a wonderful, varied score and an excellent use of sound effects. *Larry III*'s soundtrack rivals that of *Space Quest III—The Pirates of Pestulon*, one of the best-sounding games ever.

Sierra recommends an 8-MHz or faster system for the game, and the company is absolutely correct; I ran the game on an 8-MHz AT, and the speed was just right. Since many of the scenes have more than one piece of animation in them, they tend to run more slowly than the rest.

Rather than using disk-based copy protection or forcing you to pattern-match bizarre geometric shapes, Sierra has made the documentation integral to the game. The copy of *Nontoonyt Tonight: Your Guide to the Island*

List Price: *Leisure Suit Larry III: Passionate Patti in Pursuit of the Pulsating Pectorals*, \$59.95.

Requires: 512K RAM, graphics adapter (EGA recommended), 8 MHz or faster processor speed hard disk recommended. Sierra On-Line Inc., P.O. Box 485, Coarsegold, CA 93614; (209) 683-4468.

CIRCLE 409 ON READER SERVICE CARD

LucasFilm Brings Britain's Finest Hour to Your PC

GAMES
by Bill O'Brien

War is not a subject to be trivialized under the facade of game play. Someone at LucasFilm Games must understand this, because *Their Finest Hour: The Battle of Britain* (\$59.95) is more than simply a game. This sequel to the company's earlier *Battle*

period, interwoven with descriptions of the planes, armament, and strategies involved. You will also find quotations from people who were involved in the battle and two full-color battle maps. This impressive text could double as a history book.



LucasFilm Games' *The Battle of Britain* recreates brutal air combat between the RAF and the Luftwaffe.

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continues

After Hours

LucasFilm

CONTINUED

lots, they can participate in any of eight fighter scenarios or four bomber missions. Each plane type has its own set of missions. In case you complete all of the 32 combined possibilities, LucasFilm has included a separate program, *Mission Builder*, that lets you create your own customized fighter or bomber missions with up to 15 planes per scenario. It becomes an endless source of new combat.

The action of *Battle of Britain* is as superb as its background detail. A 30- or 45-minute scenario provides plenty of heart-pounding intensity, regardless of which side you choose. *Battle* supports the AdLib music board, with incredible results. Whether pumped into headphones or through your stereo, the drone of a single-engined plane or the slightly off-key melody of dual engines is an awesome, inescapable sound. Couple that with the nerve-wrenching rattle of machine guns and the thud of ordnance crashing into the skin of a plane, and you begin to appreciate the totality of the *Battle of Britain* experience.

The visuals are no less gripping. You see the sparkle of your rounds as they blast away fragments of your opponent's aircraft. When you pump enough lead into a plane, you see plumes

of smoke or intermittent bursts of flame. Worst of all, you can watch your wingman plummet from the sky. Seeing no parachute open, you may find yourself forcefully whispering, "Bail out, damn it, bail out."

And not everyone bails out. Pilots you've taken 10 or 20 hours to develop die as easily in *Battle of Britain* as in real life.

List Price: *Their Finest Hour:*

The Battle of Britain, \$59.95.

Requires: 512K RAM (640K recommended); MCGA, CGA, EGA, or VGA graphics; DOS 2.0 or later; joystick or mouse recommended. Copy protected through documentation.

LucasFilm Games, LucasFilm Ltd., P.O. Box 2009, San Rafael, CA 94912; (415) 662-1966.

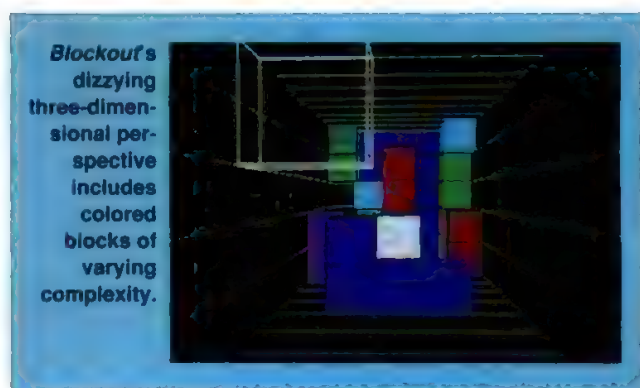
CIRCLE 410 ON READER SERVICE CARD

Arcade Titles Take Tetris into 3-D Space

GAMES
by Don Trivette

The designers of *Tetris*, last year's popular arcade game from the Soviet Union, have introduced a three-dimensional sequel called *Welltris*. In the best capitalist tradition, a Polish designer has countered with his own version of 3-D *Tetris*. What hath glasnost wrought?

The idea behind *Welltris* is to position blocks and drop them



down a well. When a row on the bottom of the well is filled with blocks, the row disappears. Your score mounts as you eliminate rows.

The secret to racking up megapoints is to fit the blocks into the 8-by-8 grid marked off on the bottom of the well, thus avoiding a pileup of blocks along the sides. Once blocks have encroached on all four sides, the game ends. As in the original *Tetris*, more points are awarded for blocks dropped from the top of the well than for those you allow to slide down the wall and skid into place.

I loved two-dimensional *Tetris* and was excited about playing a three-dimensional version, but my enthusiasm soon cooled. *Welltris* isn't what I thought it should be. Although the well itself is shown in three-dimensional perspective, the blocks are two dimensional—they have no thickness—and consequently there's no 3-D challenge. This is a two-dimensional game played on a three-dimensional board.

A figure dropped from a position spanning two walls—dropped from the corner—breaks into two different shapes when it hits the floor. That's about the only new twist *Welltris* has over *Tetris*.

Blockout was inspired by the Danish mathematician Piet Hein. He pointed out that a total of seven different irregular shapes can be formed by combining three or four cubes. These shapes can be fitted together to form a 3-by-3-by-3 cube that he called the Soma Cube.

Once again, you are called upon to drop blocks into a pit, but these blocks—components of the Soma Cube—have width, height, and depth. You can manipulate the blocks through

all three dimensions as they slowly descend into a hole, which measures 3 by 3 by 6 blocks deep. As you work to cover a layer in the pit—thereby causing the layer to disappear—you must also take into account how the shapes will fit (or more often fail to fit) into other layers.

This is a two-handed game: your right hand (on the cursor keys) moves a block around its x-y plane, while your left hand fumbles with the A, S, and D keys to spin a block in a clockwise direction around its x-, y-, or z-axis. The right-hand controls are no different from dozens of other arcade games, but the left-hand manipulations are awkward. It takes considerable hand-eye-brain coordination to get the hang of spinning an object in three dimensions.

Points are awarded based on the height from which a block is dropped and the complexity of its shape. Once you've mastered *Blockout*'s basic level, you can advance to larger pits and more-complex shapes composed of as many as five cubes. *Blockout* is what *Welltris* should have been: a Rubik's Cube of an arcade game that will give you hours and hours of frustrating delight.

List Price: *Welltris*, \$34.95.

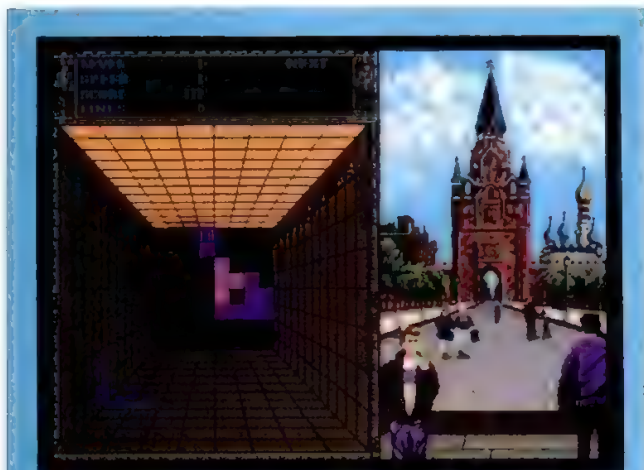
Requires: 256K RAM, graphics adapter, DOS 2.0 or later. Copy protected through documentation. Spectrum HoloByte, 2061 Challenger Dr., Alameda, CA 94501; (415) 522-1164.

CIRCLE 411 ON READER SERVICE CARD

List Price: *Blockout*, \$39.95.

Requires: 384K RAM, graphics adapter, DOS 2.1 or later. Copy protected through documentation. California Dreams, 780 Montague Expwy., #403, San Jose, CA 95131; (408) 435-1445.

CIRCLE 412 ON READER SERVICE CARD



In *Welltris*, blocks that are dropped from a corner position break apart into unusual shapes when they hit the floor.

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After Hours

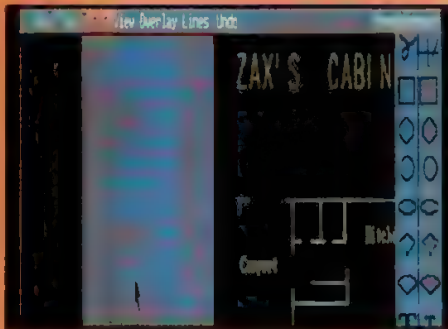
Simplified CAD: Design Your Own Home

ART & LEISURE
by Don Trivette

Aaron Spelling is completing a 56,000-square-foot house in Beverly Hills, while on a nearby mountaintop Merv Griffin's contractors are hard at work on an even larger mansion. If you've been thinking of a dream house for yourself, you might consider *Design Your Own Home: Architecture* from Abracadata Software.

Architecture is a simplified CADD program; it lets you draw floor plans and elevations in much the same way that a word processing program allows you to write letters and reports. By manipulating basic geometric shapes like lines and rectangles, you can create floor plans with

Design Your Own Home: Architecture has tools with which to design your dream house.



all the elements scaled to the proper size.

Before you create a dream house, you either select a grid size from *Architecture*'s six standard sizes or specify a custom size. Once the grid is set and turned on, via a pull-down menu, lines automatically snap to points on the grid.

Drawing a 12- by 16-foot living room is easy, but to draw a 15-foot wall, you must turn the grid off and carefully move the cursor to the 15-foot point by watching the dimension box at the bottom of the screen. Alter-

nately, changing the grid size to facilitate drawing a 15-foot wall takes several commands, and then you must use the move command to join it to other walls on the grid.

The orthogonal feature, which assures that two lines meet at a perfect right angle, is included in the grid command, so with the grid turned off, it's difficult to draw perpendicular lines. All CADD programs have grid, snap, and orthogonal features, but they are normally separate and distinct functions. Perhaps *Architecture*'s redeeming feature is its

library of canned house plans—proving that with enough patience and practice, one can indeed create some handsome drawings. The canned houses are of various styles, including colonial, Tudor, Spanish, Cape Cod, ranch, country, modern, and vacation. One of the advantages of using a CADD system is that you can modify and refine—add a garage, move a porch or a living room—so you just might come up with something exciting.

Design Your Own Home: Architecture sells for about \$100, which makes it \$70 less expensive than a low-end professional-quality CADD program like *EasyCAD 2*. Building professionals and serious home planners will pay the difference, but for amateur architects, *Architecture* is an inexpensive alternative. ■

List Price: *Design Your Own Home: Architecture*, \$99.95.
Requires: 640K RAM, graphics adapter; mouse recommended. Abracadata Software, P.O. Box 2440, Eugene, OR 97402; (503) 342-3030.

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by
Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing

Verbatim
— A Matsushita Company

Verbatim, a Kodak Company, 5¼" Floppy Disk
Double stereo, double density, 10 pack. 785-641

\$3⁸⁸

These double-stereo Verbatim disks advertised by Leiser Electronics, of Groton, Connecticut, would be great for recording voice mail.

OPERATING ENVIRONMENTS

A MAJORITY OF THE 100 LARGEST CORPORATE PC SITES IN THE COUNTRY PREDICT USERS WILL CHOOSE FROM DOS 3.X (69%), OS/2 (67%), AND MACINTOSH (64%) OPERATING ENVIRONMENTS THROUGH 1995.

Two copies per user? According to *Personal Computing* (January 1990), 100 percent of the operating-system market adds up to, ah, exactly 200 percent.

Mea Culpa: We Had a Few Things To Learn, Too

"Amstrad, a long-established participant in the mainframe world, is a relative newcomer to the PC marketplace and appears to have a few things to learn. . . ."

—*PC Magazine*, November 14, 1989 (Amstrad, although not involved with mainframes, is a relative newcomer to the U.S. PC market; the mainframe veteran our reviewer had in mind is Amdahl.)



"YOU WANNA TALK MEMORY? THIS BABY'S GOT SO MUCH MEMORY, IT COMES WITH EXTRA DOCUMENTATION, A HARD DISK, AND A SENSE OF GUILT! I MEAN I'M TALKIN' MEMORY!"

Amazing Facts How Fast RAM Chips Speed Up Your Database

"... as your records grow you may find your system running a bit slower as it searches through the database. And you may run up against the wall on volatile memory fairly soon. You may want to buy faster chips. Dynamic RAM (random access memory) chips operating at 150 nanoseconds will search faster than 60-80ns chips, but they cost slightly more."

—*Computers & Newspapers*, November 27, 1989 (Using faster-than-specified memory provides no performance gain, but if it did, it would be the 60-80ns. chips that would provide it.)

CTI 30 DAY MONEY BACK GUARANTEE

If Not Fully Satisfied With The Product, Return Within 15 Days For A Full Refund!

Just to be on the safe side, take advantage of Continental Trading's 30-day money-back guarantee in the first 15 days.
(*Computer Shopper*, December 1989)

Megabyte, Megahertz— What's the Difference?

"The model LTE (with a 9.54-megahertz 80C86 microprocessor) and the LTE/286 (12-megahertz 80C286 microprocessor) both contain an internal 20- or 40-megabyte fixed disk, a 1.44-megahertz 3.5-inch diskette, a full-size keyboard, and an optional built-in modem."

—*Popular Science*, January 1990

Contributors to *Abort, Retry, Fail?* receive \$50 and a *PC Magazine* T-shirt. Contributors this issue: Bruce Kapraszewski (operating environments equal 200 percent), James A. Huggans (CTI 30-day guarantee), Martin Connor, Jr. (1.44-megahertz diskette), David Bloedorn (faster memory for faster database searches), Philip Claridge (Amstrad mainframe), Ward Guild (double-stereo disks).

CARTOON: RICHARD TENNANT

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Reduce cost

(28-30)

- 7) If you could make any changes or improvements to our products, what would they be? (Please list your top three suggestions)

Sell them at an even lower price

(28-30)

- 7) If you could make any changes or improvements to our products, what would they be? (Please list your top three suggestions)

Drop the price /

(28-30)

- 7) If you could make any changes or improvements to our products, what would they be? (Please list your top three suggestions)

GIVE THEM AWAY FREE.

(28-30)

We've lowered, reduced and dropped
the price of the Dell System[®] 325. See inside
for details.

800-426-5150

For a free product catalog, call us. For Dell in Canada, call 800-387-5752.



GREAT IDEAS JUST KEEP COMING TO US.

Dear Customer,

Thank you for purchasing your Dell Computer Corporation personal computer.

Please take a moment to fill out and return our brief questionnaire. It's postage-paid!

1) Which PC product(s) did you purchase from Dell Computer Corporation?

a) PC model 310 40MB

b) Monitor VGA Color Plus

c) Other products Epson Printer

2) Is this your first Dell PC purchase?

a) ☐ Yes b) ☒ No

3) Are you happy with your purchase?

On a scale of 1 to 9 where 9 indicates completely satisfied and 1 indicates not at all satisfied, how satisfied are you with your purchase? (enter number)

If unsatisfied, please explain why:

4) Did your computer arrive in good working order?

a) ☒ Yes b) ☐ No

If No, what was wrong?

5) What do you like best about our computers? Please rank by importance to you. 1 = most important, 2 = next most important.

a) Product Design

b) Price

c) Quality

d) Performance

e) On-Site Service

f) Technical Support

g) Documentation/Installation Materials

6) If you could make any changes or improvements to our products, what would they be?

Smaller Footprint
High Performance graphics capabilities
Longer cord for keyboard

7) Please briefly describe one area where Dell could improve its customer service.

Clone Susan Breck. As usual
she had all the answers and
was great to work with.

8) What new products would you like to see from Dell Computer Corporation?

a) ☐ Computer Systems: Laptop

b) ☐ Peripherals:

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Turn the page and we'll show you how their input has helped Dell lead the industry in customer satisfaction two years in a row.

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